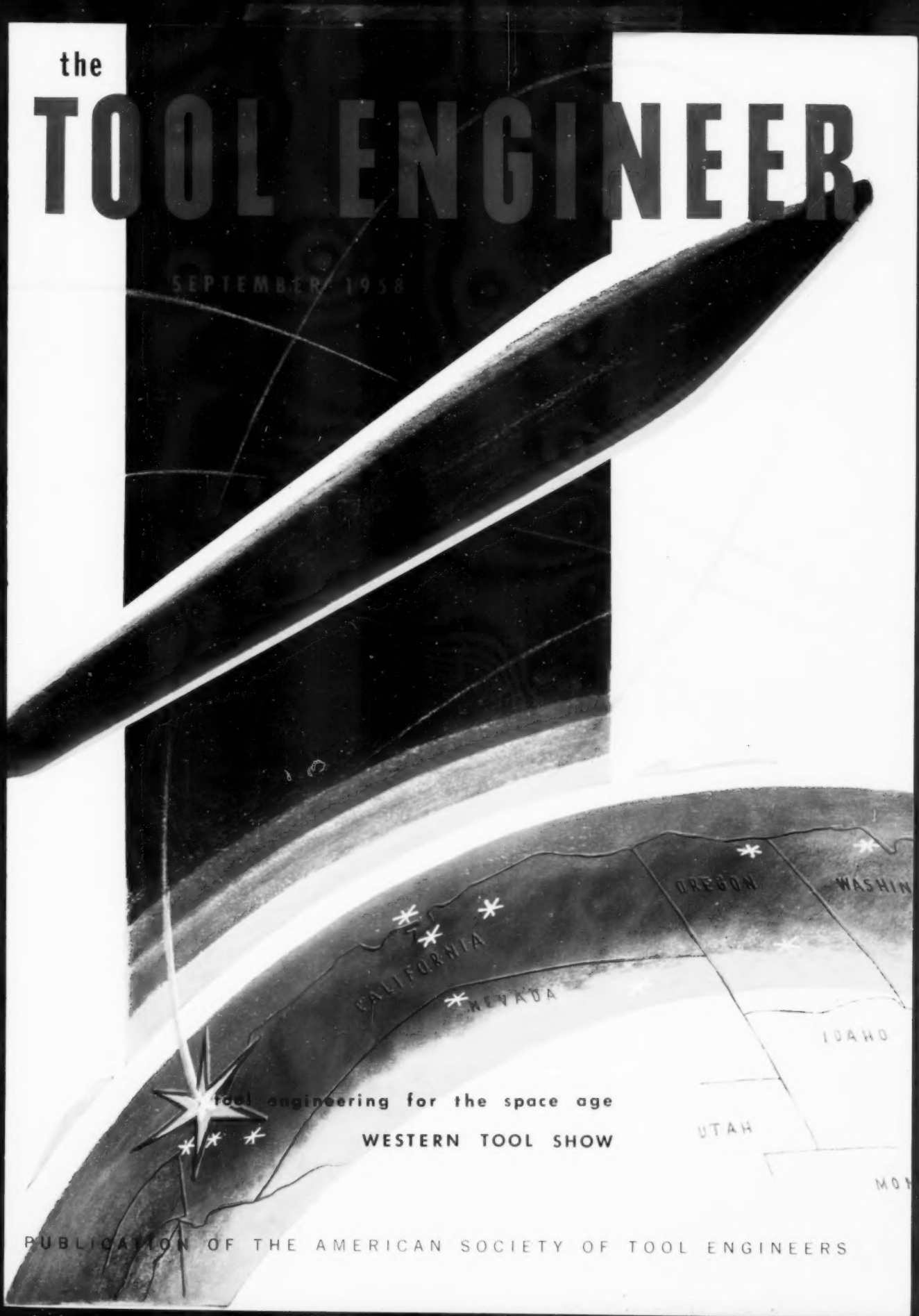
the

TOOL ENGINEER

SEPTEMBER 1958



tool engineering for the space age

WESTERN TOOL SHOW

PUBLICATION OF THE AMERICAN SOCIETY OF TOOL ENGINEERS

it's mainly a matter of TIMING!

When you replace a machine at the RIGHT TIME, it's the most profitable investment you can make

WHAT is the retirement age of a machine tool? Unfortunately, there's only one answer — "It depends." And it depends on so many things that there's a temptation to by-pass the precise computations and use some general approximations or rule-of-thumb estimates.

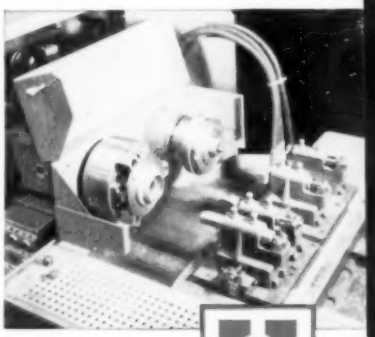
The temptation can be *costly*. For there's only one *right time* to replace a machine. A time when production cost, payoff time and carrying charges will result in the minimum net investment for your company. Too early is as bad as too late. Either way, you lose money.

If you are looking for ways to improve the profit picture, now is the tim to take a good look at your replacemen schedule. If the time is right, an inves ment in a new machine will yield a bigge return than any other investment yo can make.

Heald engineers are well experience in making obsolescence studies. An their specialized know-how in this fie is available to you at any time — to he you save money by a properly timed re placement program. Similar studies h Heald engineers have pointed the way t many important cost savings.

For example: A manufacturer of centrifugal pumps had been using a Model 48A Heald Bore-Matic (1946 vintage) to bore, turn and face miscellaneous pump parts. Could it be "retired" at a *profit?* To answer the question, a cost analysis was made, in comparison with a new Heald Model 321 Bore-Matic. Based on the figures shown below, the replacement *was* made — and at a saving of $6,335 a year!

	Old Machine	New Machine
Direct and Indirect Labor, per year	$21,550	$17,230
Scrap Losses	1,803	263
Annual Maintenance	695	220
Annual Operating Cost	$24,048	$17,713
Annual Saving for New Machine		$ 6,335



YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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HEALD

the tool engineer

Vol. 41, No. 3 September 1958

Tool Engineering for the Space Age ..... *By T. W. Black* 73
New machining, weldings, metal forming and assembly methods facilitate the production of high-speed aircraft and missiles.

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When machine operators inspect parts on a periodic basis, conditions leading to rejects can be quickly corrected.

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Hot Upsetting Produces Stronger Joints ..... *By D. C. Wherren* 115
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THIS MONTH'S COVER

An American satellite in space symbolizes the thousands of tool engineering problems that are encountered at the beginning of the Space Age. New materials and new processing methods developed for supersonic aircraft, missile and rocket work are discussed in the article beginning on page 73.

THE TOOL ENGINEER is regularly indexed in the *Engineering Index Service* and *Industrial Arts Index.*

Here are three new high-precision PRODUCTION MACHINES to give you

- more production
- more accurate work
- finer finish, and
- lower cost

(*Top*) WADE 94 Utility Lathe (*Middle*) WADE 94 Finishing Lathe (*Bottom*) WADE 94 Electric Clutch Hand Turret Lathe

Ask for literature that describes the many amazing new features.

THE WADE TOOL CO.

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THE TOOL ENGINEER

Editorial & Business Offices
10700 Puritan Ave.
Detroit 38, Mich.

Publication Office:
239 E. Chicago St.
Milwaukee, Wis.

THE TOOL ENGINEER is published monthly in the interest of members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the act of March 3, 1879. Yearly subscription: members $2.00; nonmembers, $6.00; Canada, $6.50, and all other countries, $8.00. Copyright 1958, American Society of Tool Engineers.

Stimulating Industrial Growth

Progress in machine tool design has never been greater. Unfortunately, in many plants productivity is limited by equipment that is, in a sense, obsolete. Even though existing machines may function satisfactorily, there are modern machines that will do the job faster, more accurately, more economically.

The gap between production by yesterday's methods and production by today's methods represents an economic loss to the companies concerned. It also represents a major loss of American production potential.

There is no ready solution to this problem. However, the Federal Government can do much to provide an economic climate that is favorable to the growth of industrial productivity.

Probably the most effective step that could be taken is to provide new and more realistic depreciation allowances, permitting write-off periods of seven to 10 years, rather than the 15, 20 or 25-year periods that have been past practice.

This is the recommendation of the National Machine Tool Builder's Association. It has been endorsed by dozens of other groups in industry.

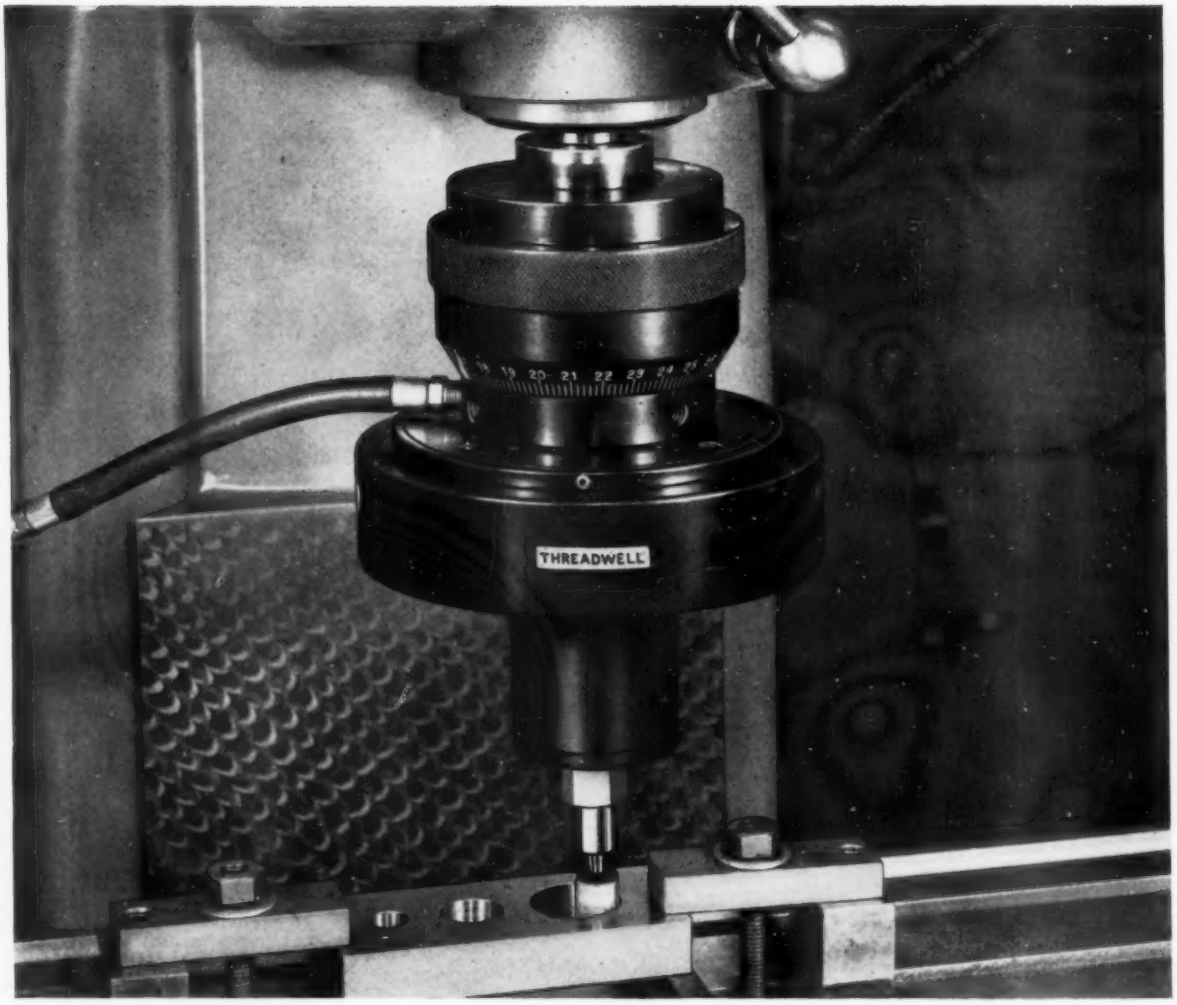
Realistic depreciation policies will permit realistic planning by management and will accelerate the introduction of modern machines. As added benefits, they will stimulate the continued growth of the machine tool and durable industrial equipment industries. Far from causing any loss in tax revenue, the expansion of business would actually create new revenue.

Any measure that results in greater productivity benefits everybody in the country—producers of machine tools, producers of consumer goods, and consumers. In Canada and Western Europe this fact is recognized. Write-off periods range from five to ten years.

Governments of other countries have chosen to stimulate industrial growth. Why aren't we doing it here?

Theodore W Black

SENIOR ASSOCIATE EDITOR



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GRIND-A-MATIC

provides jig grinder performance at drill press prices

The new Grind-A-Matic is an air turbine grinding head which can be mounted either vertically or horizontally on almost any machine tool.
Its versatile application and high precision performance allow Grind-A-Matic to perform grinding operations normally done on an expensive jig grinder. Mounted the same as any standard tool, it becomes a close tolerance grinder for such work as internal grinding of tools, dies and fixtures.

- *Fine radial adjustment from "0" to .070" while the spindle is rotating.*
- *Uninterrupted precision grinding*
- *Coarse adjustment from "0" through 1¼"*
- *Spindle speeds from 50 to 75,000 RPM*
- *Standard range from ⅛" to 2½" holes*
- *Adapted to include holes up to 5½"*
- *Sealed air turbine and spindle bearings*

Write today for complete information on this versatile grinding head

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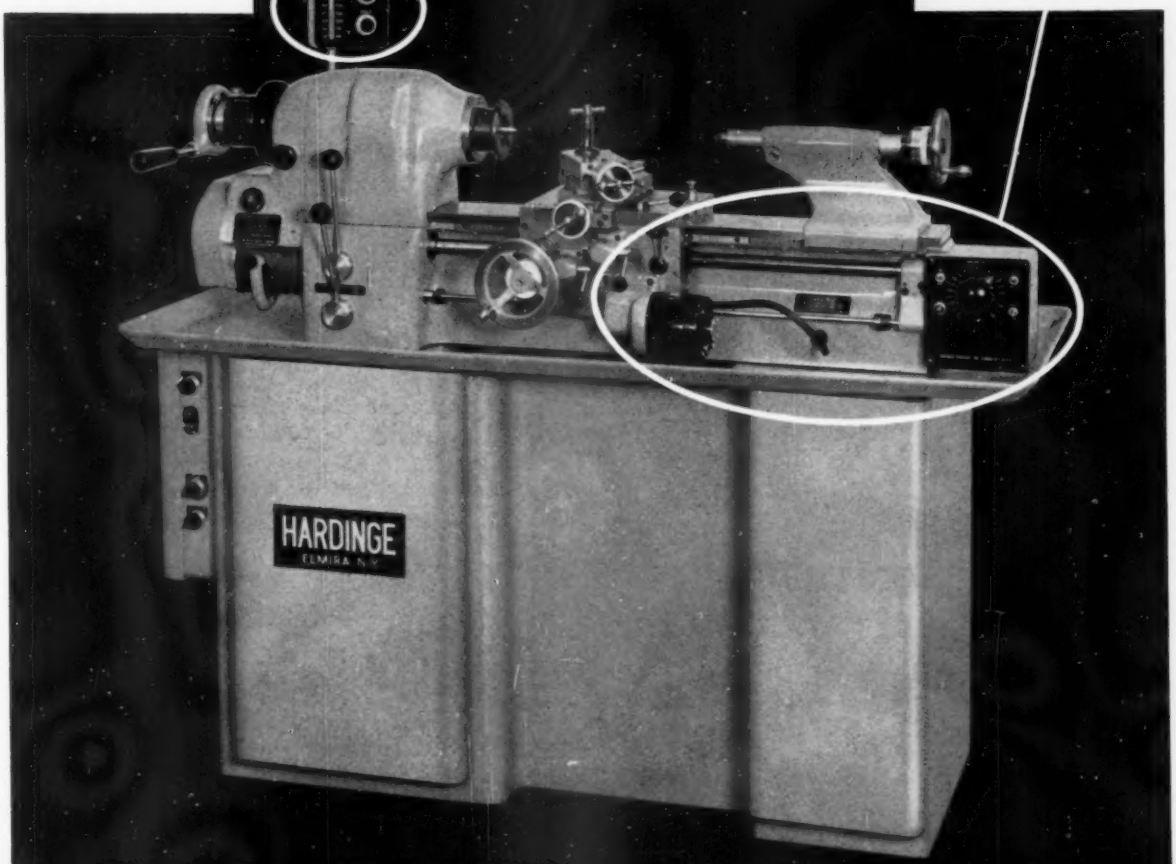
Tool Room and Production Lathe

Features

Infinite Control of Speed and Feed

Variable Speed Drive for Headstock Spindle

Variable Feed Drive for Carriage and Cross Slide



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Both drives are independent and infinitely variable to secure every possible combination of speeds and feeds.

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a new concept in power brushing tools

How TY® BRUSHES will significantly cut your finishing costs

Designed for jobs *beyond the reach* of standard wire power brushes, Osborn TY® Tool Brushes are literally a new concept in finishing tools.

Where rotary files, abrasive stones or belts, tumbling and shot blasting equipment have been used—TY Brushing Methods now do many of these jobs *better . . . at significantly less cost.*

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- Maximum of work efficiency with minimum of pressure
- Greatly increased brushing action strength
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- Complete uniformity of finish
- Exceptionally long brushing tool life

Osborn TY Brushes will give you a higher rate of output . . . better product quality . . . lower end-of-service cost. Write or call us today for full information. No obligation, of course. *The Osborn Manufacturing Company, Dept. K-50, Cleveland 14, Ohio.*

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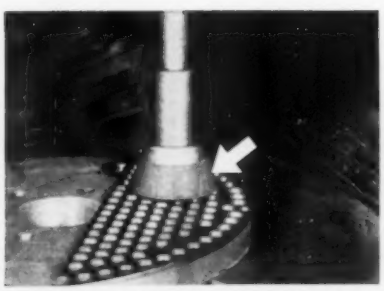
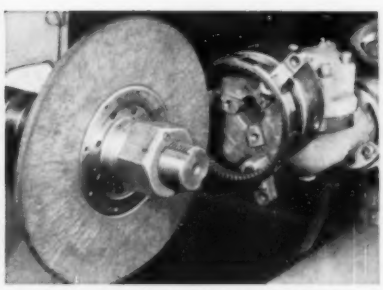
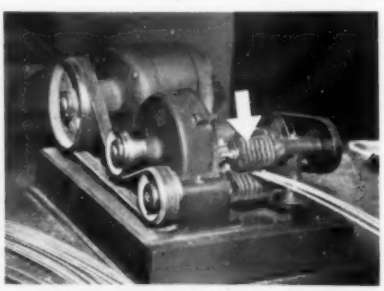


DEBURRING EDGES OF HOLES *on surface of tube sheet is done faster . . . more thoroughly with Osborn TY Cup Brush on Osborn's Brushamatic® 51-1L Machine.*

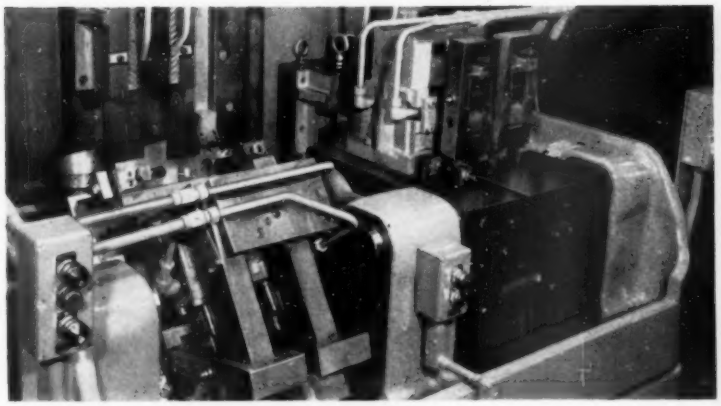


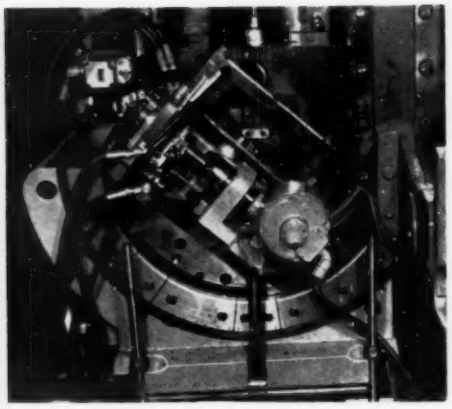
BLENDING GEAR TOOTH EDGES *and deburring in a single precision operation is done with Osborn TY Monitor® Brush running at 1750 rpm on Brushamatic® 3A Machine.*



WIRE STRIPPING *is fast, uniform, low cost with Osborn TY Insulation-Stripping Brushes that fit standard wire stripping machines . . . such as dual-stripper shown.*

Let "Broaching Headquarters" **REBUILD** and/or **RE-TOOL** your **BROACHING MACHINES**





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in building broaching equipment exclusively. This is a sound background, more than is available anywhere else! With the engineering know-how, and our skilled mechanics, we can be responsible for the complete rebuilding and re-tooling job.

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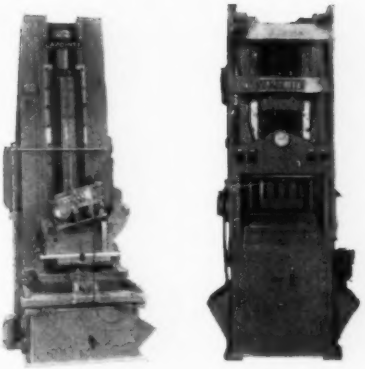
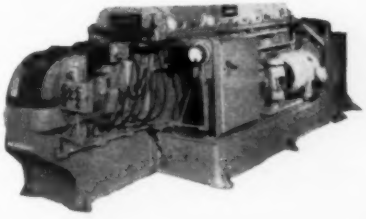
The Lapointe *full guarantee* applies to each rebuilt Lapointe machine and fixture. Get our estimate for rebuilding or re-tooling any of your broaching equipment.





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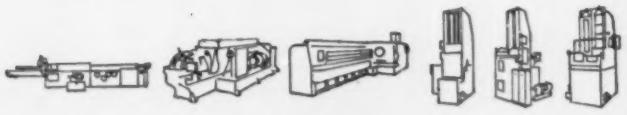

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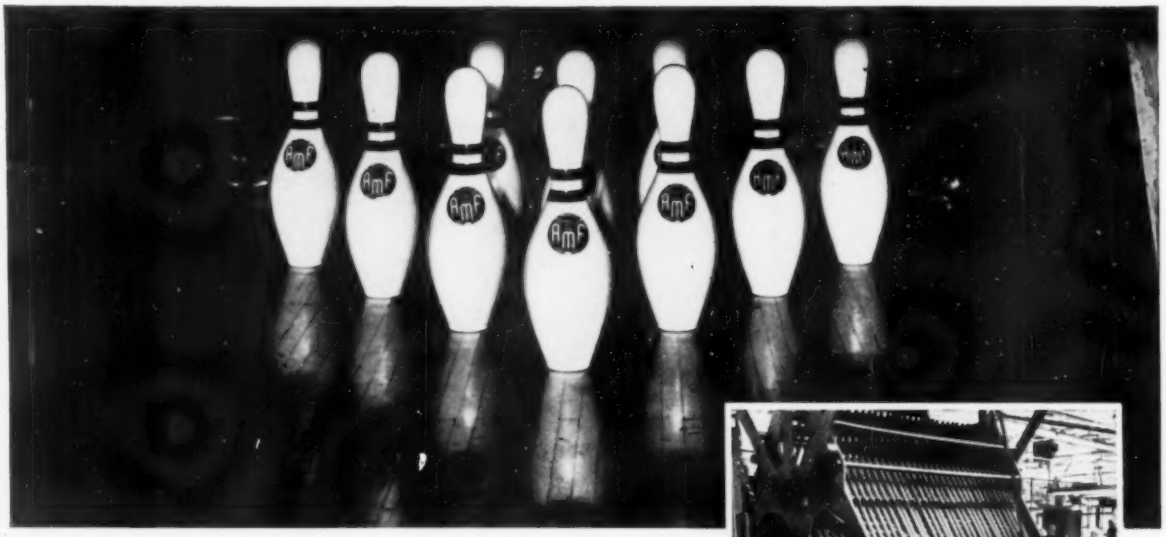
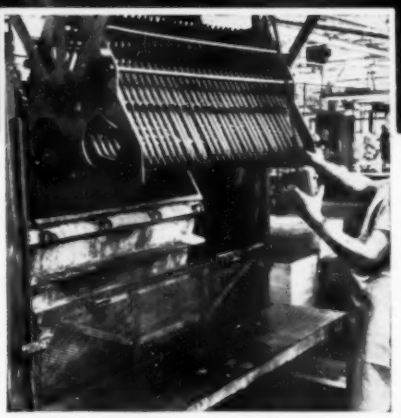
Report from AMF...Leading Manufacturer of Automatic Pinspotters:





At American Machine & Foundry's Buffalo plant, Almco barrel finishing equipment imparts a fine microinch finish to distributor tracks used in bowling's automatic pinspotter.

ALMCO Barrel Finishing Solves $37,000 Problem By Improving Finish On Track Mechanism

HERE'S HOW ALMCO BARREL FINISHING saves American Machine & Foundry Co. $37,000 a year on an intricate product — an automatic pinspotting machine!

The pinspotter — a fully-automatic unit for setting bowling tenpins — had developed an isolated problem spot: A nylon gear which meshed with the teeth of the distributor track was rubbing against microscopic rough spots and surface irregularities. This caused the gear to wear at a faster-than-normal rate.

IMPROVING THE TRACK FINISH by usual methods required about 70 minutes for each track. Cooperation between AMF and Almco engineers, however, resulted in a special "fixture" to hold 29 track units in an Almco Model DBF-800-48-1 barrel finishing machine.

Tracks now attain a 32 microinch finish at a time rate of 10 minutes each. Costs were cut $37,000 annually, and the complete Almco installation actually paid for itself in less than five months!

Do you have a finishing problem on large parts? Or do you have smaller parts that must be accurately deburred and polished? In either case, find out what Almco barrel finishing can do for you.

ALMCO'S TECHNICAL STAFF will examine your product parts and provide sample processing. You'll get a detailed report with recommendations. No obligation, of course. Send in your sample parts with specification requirements. Your Almco sales engineer can make the arrangements, if you wish.

Sample parts processing is conducted in this modern Almco test lab. Simply write on letterhead to request arrangements or send parts direct to Almco at Albert Lea, Minnesota. Enclose specifications required.

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POPE 1, 2 and 3 HP Totally Enclosed 1800 and 3600 RPM Motorized, Cartridge Type Spindles with double row cylindrical roller bearings of enormous capacity for superior performance and long life, plus separate thrust bearings for no endwise movement of the shaft.

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POPE ¾ to 100 HP Direct Motorized Spindles operate in any position — flanged or tapered noses — equipped with super-precision, double-row roller bearings and preloaded ball thrust bearings. Top quality performance is assured on skin milling, grinding, boring and other operations as well as milling.

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POPE Super-Precision 1 HP, 3600 RPM Motorized Tool and Cutter Grinder Clearance Angle Swivelling Heads provide angular adjustment in a vertical plane. They pay for themselves in time saved. Cup wheels can be used for practically all clearance angles.

FOR BORING ROUND HOLES WITHIN MILLIONTHS OF AN INCH

POPE Heavy Duty Boring Spindles assure smooth, chatter free, continuous high production of accurate parts. Belt driven or motorized, in a wide range of horsepowers and speeds.

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POPE Precision Internal Grinding Spindles have the super-precision bearings to withstand both axial and radial loads and to produce better finished ground holes. Their ability to take heavy cuts means increased production. Wheel life is increased, too. For Bryant, Cincinnati, Excello, Heald, Landis and Norton Grinders.

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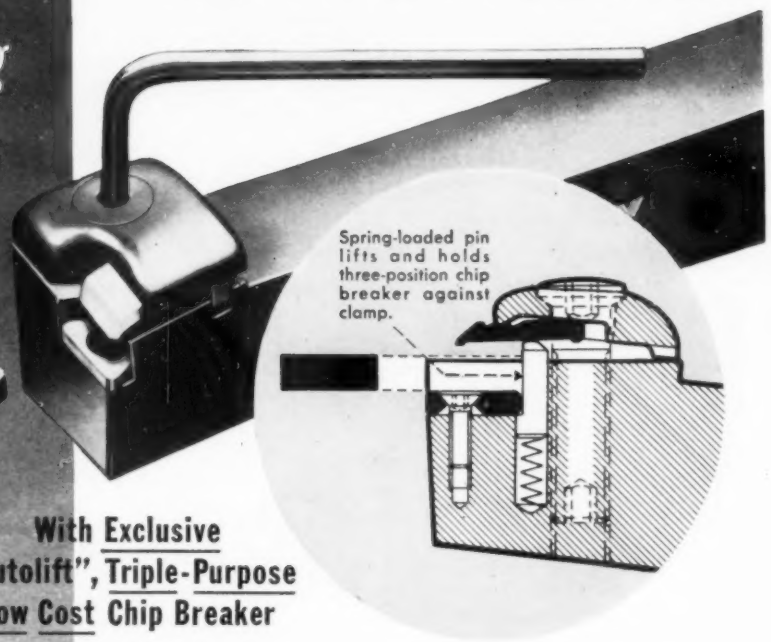
Fastest-Changing Toolholder

SANDVIK Coromant T-MAX



With Exclusive "Autolift", Triple-Purpose Low Cost Chip Breaker

Same Wrench Operates Screw From Top Or Bottom. Saves Time on Multi-tool Set Ups.

NEW COROMANT INSERT DISPENSER
Handy, spring-action dispenser automatically puts a new insert at user's fingertips. Calibrated slot shows remaining inserts.

Loosen, change, tighten... and you're back in production. It's as quick and easy as that with Coromant T-Max... *newest*, fastest throwaway-type, carbide toolholder on the market.

Only T-Max enables you to change either or *both* the carbide cutting edge and depth of cut *without removing or replacing chip breaker.*

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- Precision-made recess seats insert *accurately*—insures machining precision.
- No protruding parts—two or more holders easily clamped together.
- Shank of heat treated alloy steel, HRC 50, guards against damage. Special SR treated, anti-rust finish.
- Precision cast, alloy steel clamp is streamlined for free chip flow.
- Low cost chip breaker cuts replacement expense.

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Covering various T-Max Styles and other data... or contact your nearest Coromant office or distributor for a T-Max demonstration today.

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*Patent Applied For

SS 167

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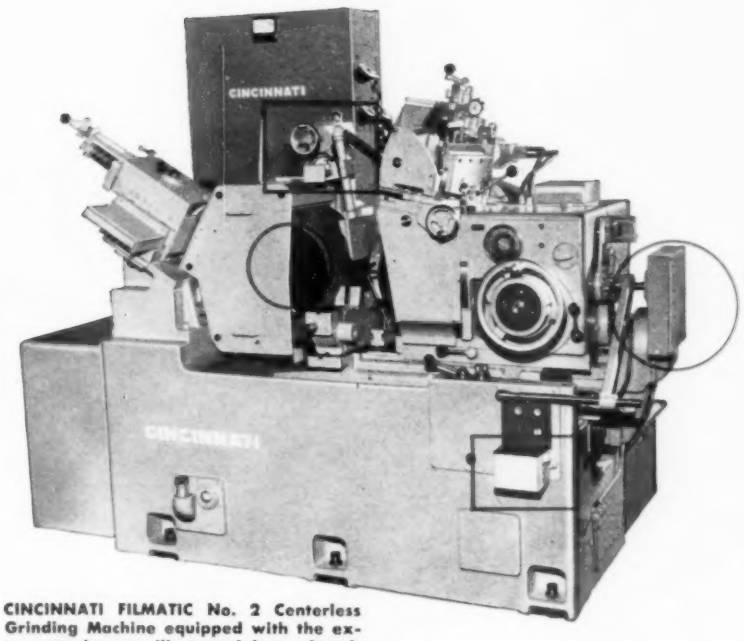
LOOK WHAT'S NEW

in Low-Cost Centerless Grinding



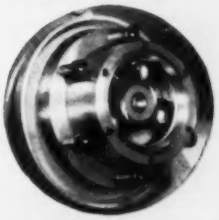
CINCINNATI FILMATIC No. 2 Centerless Grinding Machine equipped with the extra attachments illustrated here. Standard machine catalog No. G-644-4.

. . . New Types of Equipment now available for CINCINNATI FILMATIC Nos. 2 and 3

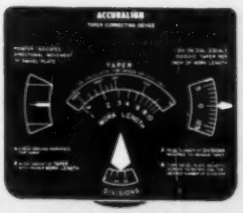
In addition to the many advantages offered by the new CINCINNATI Centerless Attachments and extra equipment illustrated here, the machine itself will give you far superior performance because of FILMATIC grinding wheel spindle bearings . . . anti-friction infeed slide . . . infinitely variable regulating wheel speeds . . . quality controlled castings. Cincinnati is tops for your replacement program; for producing your new products; for engineering service. Preliminary information in Sweet's Machine Tool File.

Grinding Machine Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

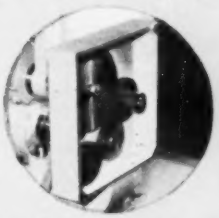
New Spindle End Adjustment Unit with dial indicator. For quick, accurate axial adjustment of grinding wheel spindle, when setting up for infeed grinding operations. 3/8" total adjustment available.



Automatic Grinding Wheel Balancing . . . an exclusive feature. Freely rotating steel balls automatically balance the wheel mount when unclamped. Perfect balance is attained in a few seconds. Ask for demonstration.



New Precision Indicator Attachment for taper correction. Provides a visual check on the amount of regulating wheel unit swivel adjustment, measured in increments of .000010" per inch. Top of unit shown here.



New Vari-Pitch Unit for hand infeed grinding. A simple change gear arrangement gives the operator a choice of three throat openings for maximum safety and convenience in loading infeed work.

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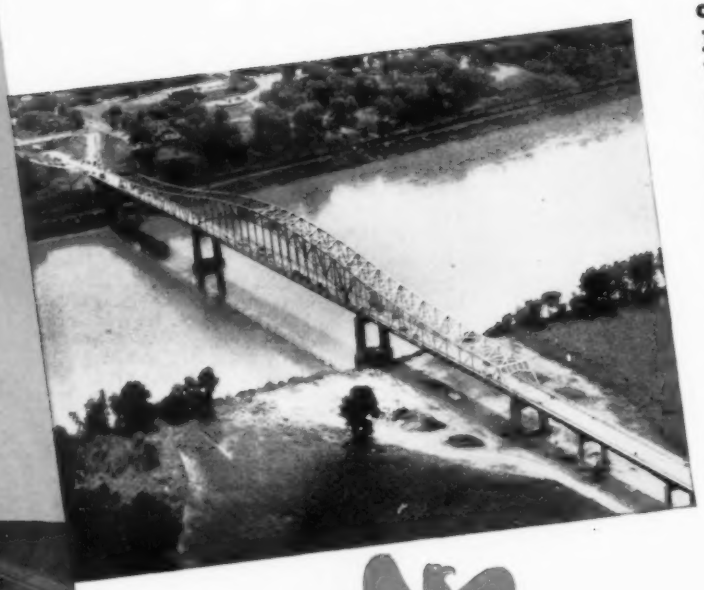
THE THOUSANDS OF HOLES

required in the construction of the recently completed Jefferson City, Missouri bridge by Stupp Bros. Bridge and Iron Company, of St. Louis, Missouri, were all drilled by "AMERICAN" Hole Wizard Radials.



One of the oldest and largest bridge builders and steel fabricators of the Middle West, Stupp Bros. use "AMERICAN" radials exclusively for their drilling operations. Their main reason for using "AMERICAN" exclusively is LOW COST PER HOLE.

Quick Handling—Fast Penetration—Low Maintenance are the prominent contributing factors.

"AMERICAN" Radials can be relied upon to pay excellent returns upon the user's investment.

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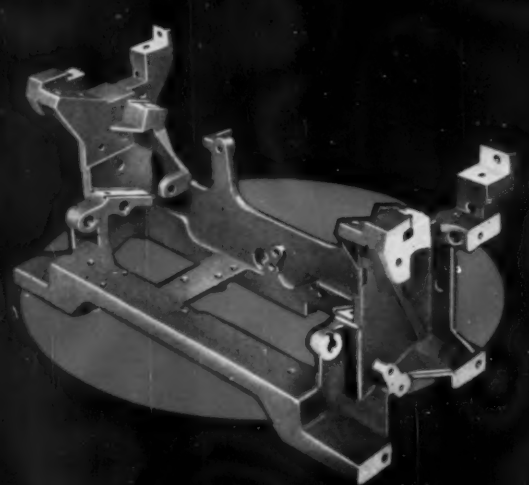

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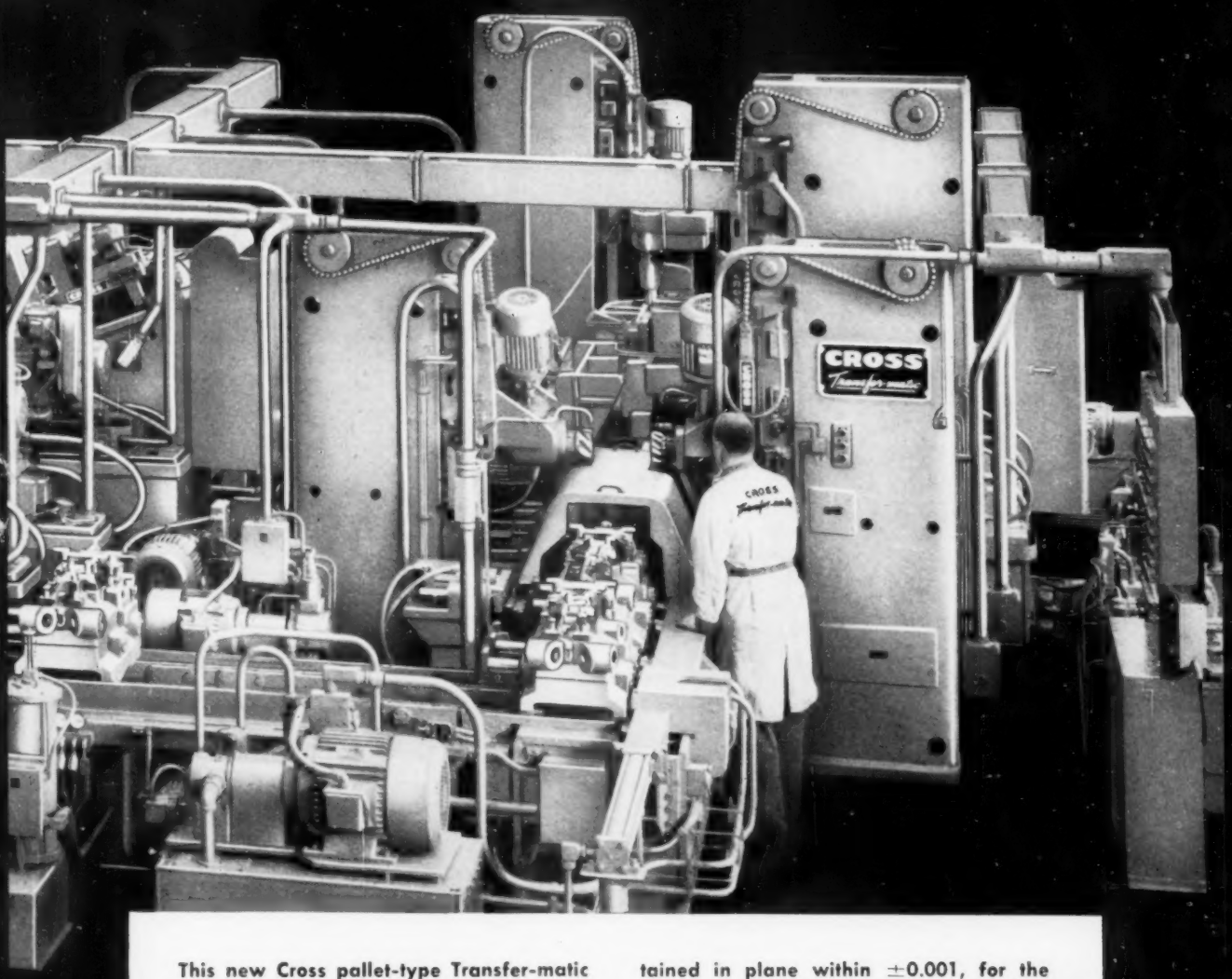

This new Cross pallet-type Transfer-matic completely machines aluminum die cast power frames for typewriters at a rated capacity of 150 per hour.

One hundred and five broaching, milling, drilling, reaming, spotfacing, chamfering and tapping operations are performed on each part. The delicate castings are precisely power clamped in pallet-type, two-position work holding fixtures, and transported through a loading station and eleven machining stations. Each part travels through the machine twice. On the first trip, the top, bottom and back side are exposed to the tools. On the second trip, the ends are exposed.

Tolerances for the rail seats are maintained in plane within ± 0.001, for the overall length within ± 0.003, for the shaft holes in line from end to end within ± 0.001, for the hole locations relative to milled surfaces within ± 0.003, and for the four broached spring seats in plane within ± 0.005.

A Cross Machine Control Unit with Toolometers programs tool changes to minimize down time. Standard Cross Tool Setting Fixtures are used to pre-set all tools, thus eliminating trial cuts and adjustments.

Other features are complete interchangeability of all standard and special parts for easy maintenance, construction to JIC Standards, hardened and ground ways and automatic lubrication.

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for all layout and inspection work

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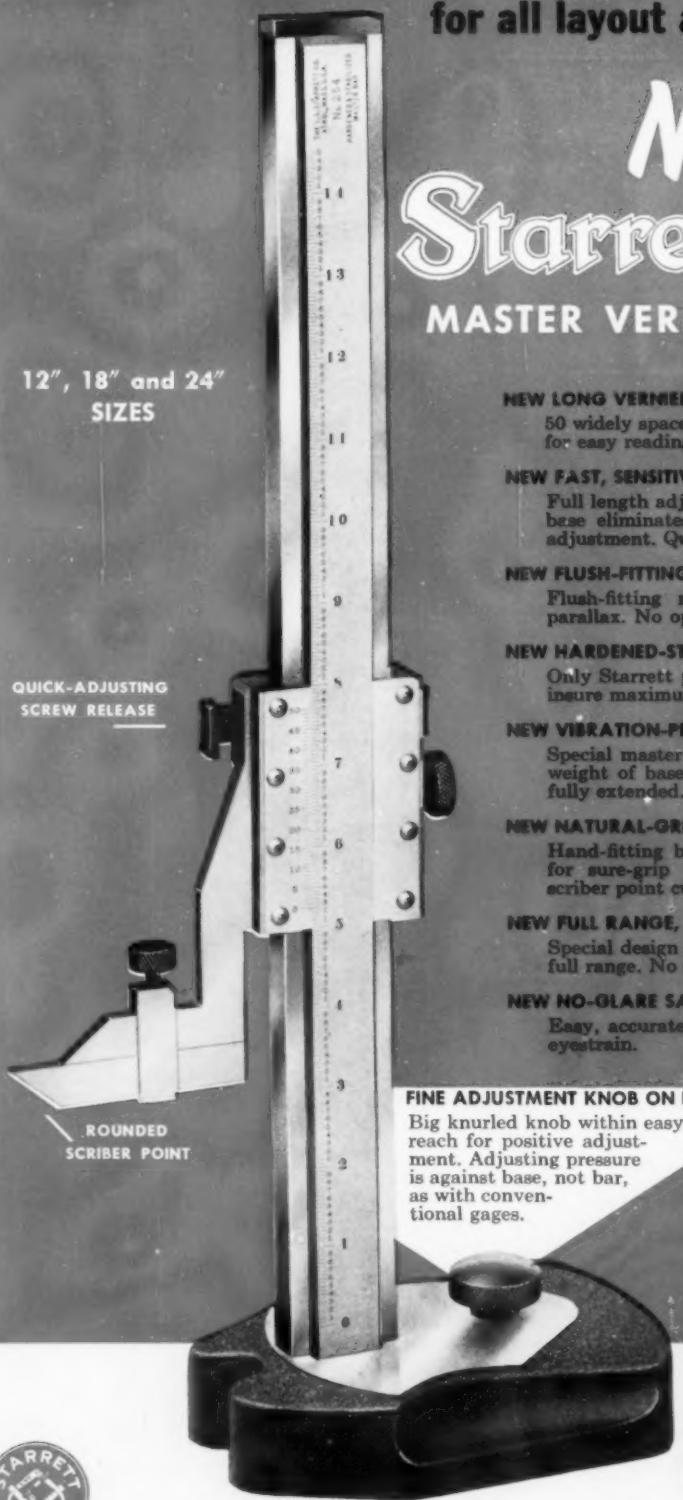

NEW LONG VERNIER, OPEN FACE DESIGN
50 widely spaced graduations — half the usual number — for easy reading or setting without a magnifying glass.

NEW FAST, SENSITIVE SLIDE ADJUSTMENT
Full length adjusting screw with fine adjustment knob on base eliminates reaching, gives smooth, full range, fine adjustment. Quick adjustment by split nut on screw.

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Flush-fitting master bar and Vernier plate eliminate parallax. No optical reading errors.

NEW HARDENED-STABILIZED MASTER BAR
Only Starrett provides hardened bars on Vernier tools to insure maximum rigidity, lasting accuracy.

NEW VIBRATION-PROOF DESIGN
Special master bar construction plus substantial size and weight of base eliminate vibration — even with scriber fully extended.

NEW NATURAL-GRIP BASE
Hand-fitting base design with convenient finger grooves for sure-grip handling and easy movement. Rounded scriber point cuts clean, sharp lines with less pressure.

NEW FULL RANGE, DIRECT READING DESIGN
Special design permits direct readings from base over the full range. No calculations to introduce errors.

NEW NO-GLARE SATIN CHROME FINISH
Easy, accurate reading in any light without squinting or eyestrain.

FINE ADJUSTMENT KNOB ON BASE
Big knurled knob within easy reach for positive adjustment. Adjusting pressure is against base, not bar, as with conventional gages.

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HOW DAIMLER-BENZ SAVES ON THIS JOB

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

HOW THE TIMKEN COMPANY SAVES OVER 20% ON 220 PARTS

Bearing races machined faster and simpler with JETracer on No. 24's

You've got it made when you can machine 220 different parts on an *automatic* lathe with minimum change-over and tooling investment. This setup at The Timken Roller Bearing Company's Canton, Ohio, plant is really impressive.

Here are some of the production advantages gained by the installation of two Gisholt MASTERLINE No. 24 Automatic Production Lathes, with JETracer-controlled rear independent slides:

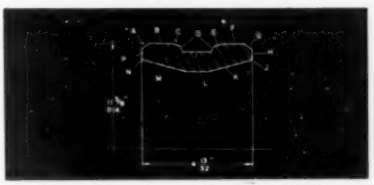
Increased production—Time is cut better than 20%. Here's the machining sequence on a typical, 11⅜″-diameter, 4$^{13}/_{32}$″-wide steel bearing race forging. For the first operation, location is at P and jaws hold on the middle of the body at D. The JETracer rough-contour-bores K-L-M. At the same time, the front independent slide feeds longitudinally to chamfer G and then cross-feeds to face H and chamfer J. The JETracer finish-bores K-L-M, completing the operation in 4.30 minutes floor-to-floor time. The part is held on a spring-loaded plug in taper K for the second operation. Location is against H and a drawback fixture clamps in taper M. The JETracer roughs B-C-D-E-F, while front independent slide tools feed longitudinally to chamfer N and then cross-feed to face P, form radii A-G and form-turn D. The JETracer then finishes surfaces B-C-E-F. Time is only 3.50 minutes f.t.f.

Added capacity—LESS FLOOR SPACE—Two machines handle parts ranging from 10⅝″ to 32″ diameter, 2″ to 9″ wide, and replace several other machines formerly required to do the same job.

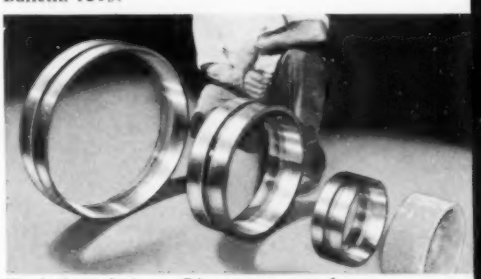
Versatility—Two machines handle first and second machining operations on approximately 220 different parts. Tooling costs are minimized by JETracer-controlled rear independent slides. Each has four-position indexing template carrier for one to four passes at the work during the automatic cycle. JETracer generates front and back angles up to 31 degrees, and carries a roughing and a finishing tool. On the final cut, the finishing tool automatically indexes into position for greater accuracy and a smoother finished surface. Feed rate of the JETracer slide is automatically varied to give uniform cutting speed on all surfaces for longer tool life and finer finish.

Quick change-over—All tracing templates are made to fixed length dimensions and locate against dead stops to eliminate adjustment. Swivel chuck jaws with inserts compensate for changes in part length. Four sets adjust to cover entire range of work. Tool holders and insert-type tool blocks are used to permit sharpening and presetting in the toolroom to eliminate chance of operator error and minimize machine down time.

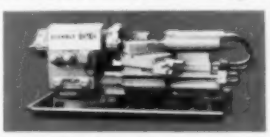
Add the preceding to the EASE with which the No. 24 can be set up, adjusted and operated, and you have a work-, time- and cost-saving combination that's hard to beat.



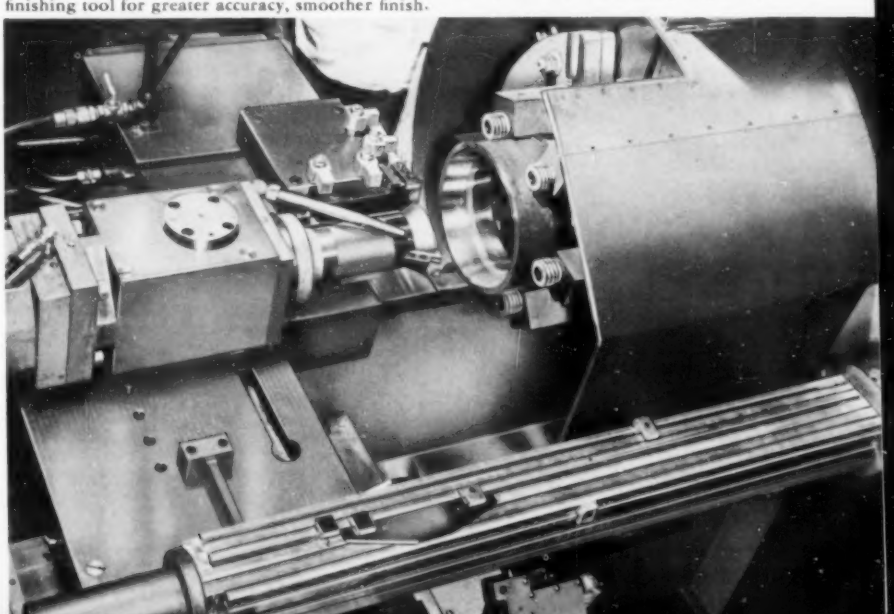
A new catalog on the No. 12 and No. 24 Automatic Production Lathes illustrates features, accessories and typical jobs. Ask for Bulletin 1213.



Typical workpieces. Diameter range, from left to right: 25″, 18″, 11⅜″. Rough forging at far right shows amount of stock removal required in the two fast, automatic operations.



Rear overhead view of first-operation tooling. Note four-position indexing template carrier in foreground. Tracer boring bar generates front and back angles and carries a roughing and a finishing tool for greater accuracy, smoother finish.



HOW DAIMLER-BENZ SAVES ON THIS JOB

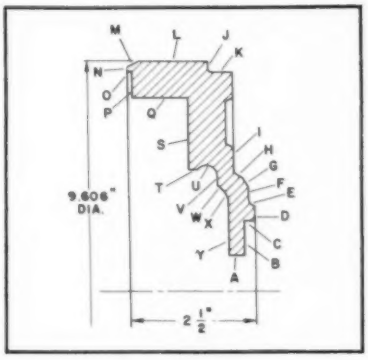
Combined cuts, multiple tooling improve accuracy ...increase output

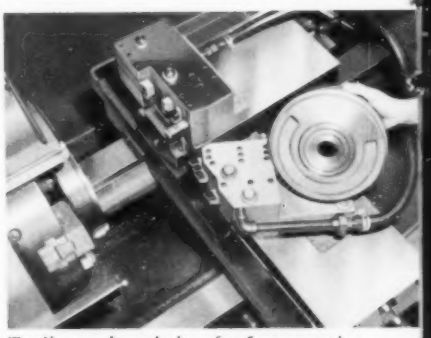
For fast, automatic machining of flywheels or similar parts, this setup at the Daimler-Benz plant in Mannheim, Germany, will give you some cost-cutting answers. Two Gisholt MASTERLINE Simplimatics are used. Tooling is planned for fast, easy change-over between different part sizes. One operator handles both machines. Here's how a typical, 9½"-diameter, 2½"-wide part is machined:

Operation 10—The workpiece is chucked in the co-bore Q, locating against a back-face S. Tools on the front independent slide face D-F-I-J and shave K. At the same time, tools on the rear independent slide finish turn K, finish face J, form radii at H and E, bore C, shave face B, rough and finish bore A and chamfer G. Nine different tools are used to machine 11 surfaces in only 2.5 min. f.t.f. time.

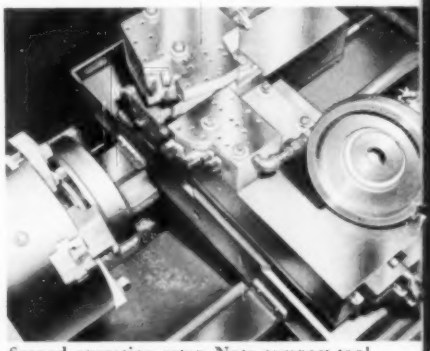
Operation 20—The workpiece is then placed in the second Simplimatic, locating against face I and chucking at K. Front slide tools face N-P-S-V-Y and form U, while rear slide tools turn L, form M-W-X and bore O-Q-T. Ten tools are used to machine 12 surfaces in only 2.1 min. f.t.f. time.

Simplimatic's wide platen table permits placement of slides and tools in proper relation to work, and permits machining greater number of surfaces in one chucking. Multiple cuts combine with automatic cycle to improve accuracy, save time and lower costs. Basic flexibility simplifies toughest jobs...often saves costs of special machine.





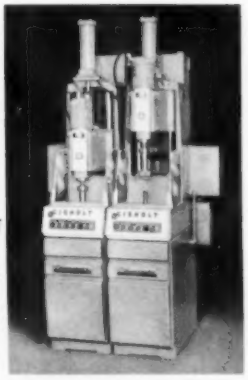
Tooling and workpiece for first operation. Rigid tool mounting provides fine finish in spite of severe, interrupted facing cut.



Second-operation setup. Note compact tool arrangement, possible only through Simplimatic's flat platen table permitting maximum tooling flexibility for all types of work.

SETUP DOUBLES PRODUCTION ON AUTOMATIC TRANSMISSION PARTS

Two-spindle Superfinisher delivers 240 parts per hour

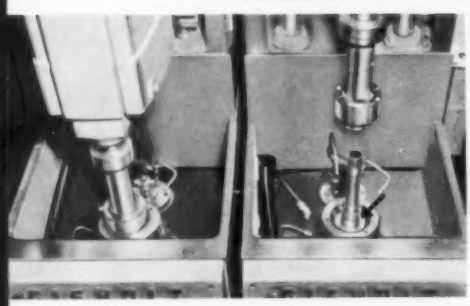


General view of the two-spindle Model 81 Superfinisher setup.

Perhaps a setup like this can pay you a profit, too. It features the Gisholt MASTERLINE Model 81 Vertical Superfinisher, designed to produce a "controlled" surface finish on flat, conical or spherical surfaces at high production rates. The vertical design requires minimum floor space and permits easy addition to existing production lines. Here is how it is used on automatic transmission hub and turbine shafts at a well-known automotive manufacturer's plant.

The operator places the 5¼"-diameter, 9"-long part in a fixture, centralizing and driving in the large bore, with the shaft extending upwards towards the Superfinishing head. He presses the cycle start button and the upper stone-carrying head descends. The quill is hollow and goes over the shaft so that the cup-type Superfinishing stone can engage the seal surface on the clutch hub. In just a few seconds the precision-faced surface is reduced from 80 to the desired 20 micro-inch RMS finish. At the end of the automatic cycle the quill raises to clear for unloading. Floor-to-floor time is only 25 seconds.

This two-spindle Model 81 is easily handled by one operator. While one spindle is in use, the operator is unloading and inserting a new part on the other. Superfinish is faster than methods previously used, and "tandem" setup gives total production of 240 parts per hour at 80% efficiency.



Superfinish quill (hollow) moves over shaft at left unit to engage cup-type stone with seal surface. Quill is retracted at right unit for unloading. Superfinished seal face is indicated by arrow.

Simple, compact setup requires minimum floor space; doubles operator productivity; exposes true base metal on important seal surface for long, trouble-free operation. Superfinish provides any desired surface finish in less time and at lower cost.

ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT

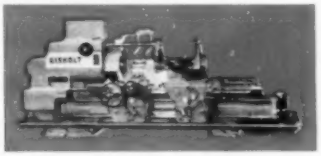
SMART SETUP IMPROVES ACCURACY ON MULTIPLE BORE JOB

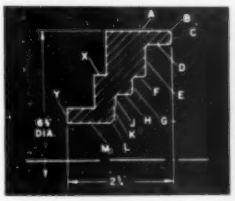
Hi-Lo feature on Speed Selector saves additional time

MASTERLINE GISHOLT SINCE 1887

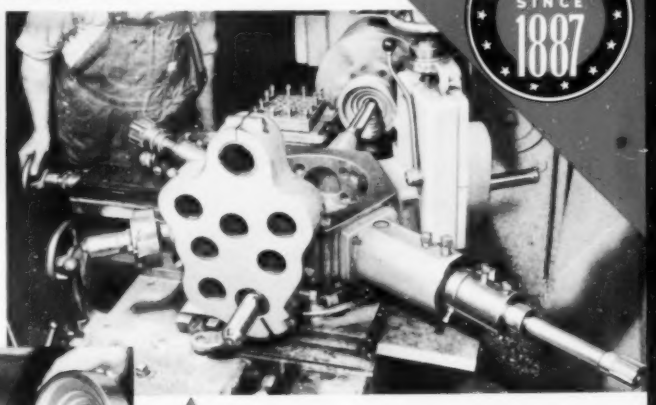
You may get an idea from this typical job-shop setup on a Gisholt MASTERLINE 2L Saddle Type Turret Lathe. It shows how to achieve accuracy, smooth finish, parallelism and concentricity on multiple boring operations, at low cost.

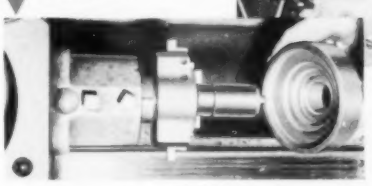
The Gisholt Hydraulic Speed Selector is an important factor in achieving a quality finish and maximum tool life on this job. Offering a choice of DIRECT or PRE-SET operation, the operator selects correct spindle speeds by simply aligning work diameters with the Hi-Lo Lever on the Selector Handwheel. In DIRECT operation, speed changes are actuated by turning the handwheel to a new setting. In PRE-SET operation, the next speed is selected during a cut and when needed, is obtained by a touch on the Hi-Lo Lever. In either case, the speed shift is completed without any further attention from the operator while he positions his tools for the next cut. The Hi-Lo Lever may also be used to provide an instant speed change in a ratio of 6:1, without moving the selector handwheel. For this setup the Speed Selector is operated DIRECT.





Close-up of part and spade cutter on hex 5 used to simultaneously finish co-bores D-F-H and shave faces C-E-G-J. Note smooth finish obtained.





Simple tooling setup for reverse clutch housing. Note fully tooled hex turret...with multiple turning head and adjustable slide tool in place, providing flexibility for quick setup on other jobs.

The workpiece, a cast semi-steel reverse clutch housing, is located against back face Y and chucked on previously turned diameter X in a 3 jaw scroll chuck. A is rough turned from the square turret while M is drilled from hex 1. Other square turret tools rough face C, rough co-bores D-F-H and relief K. M is semi-finished from hex 2. The operator taps the Speed Selector Hi-Lo Lever for an instant, 6:1 speed change, and reams bore M from hex 3. He raises the lever to return to the previous speed and chamfers L from hex 4. Next, a high speed steel spade cutter on hex 5 simultaneously finish co-bores D-F-H and finish shave faces C-E-G-J. He uses the Hi-Lo Lever again to ream H from hex 6 and rotates the selector to a new speed to finish turn A, chamfer B and break the sharp edges on the co-bores from the square turret. Floor to floor time ...16 minutes.

Spade cutter handles 3 co-bores, 4 faces in one pass to assure accuracy. Hi-Lo feature on Speed Selector automatically provides proper speeds when going from drilling, turning or boring, to threading, forming or reaming.

MACHINE SPECIALTIES AUTOMATES RAM TYPE LATHE...SAVES 25%

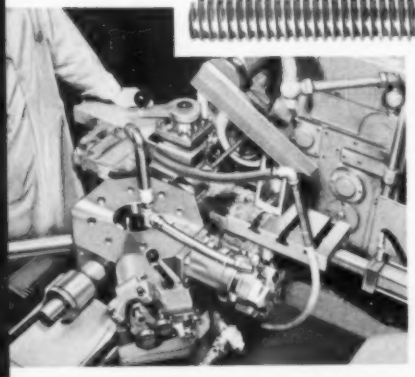
Hydraulic drive takes over, frees operator for other work

If you're doing job-lot or contract work, you can profit from this setup at Machine Specialties, Chicago, Ill. It'll show you how to cut tooling costs, increase production and beat the "profit squeeze" through automatic operation of hand-operated machines.

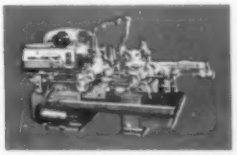
Here are a few of the advantages offered by specifying hydraulic drive operation for your new ram type turret lathes: consistent, automatic cycle permits accurate time estimates for accurate, competitive bidding; proper speeds and feeds are automatically selected and offer uniform quality, longer tool life; the operator has plenty of time to handle additional units or perform other work.

Here is how it works on ⅜" Acme adjusting screws, machined from leaded screw machine bar stock in lots ranging from 500 to 2500 pieces. The machine is a Gisholt MASTERLINE No. 5 Ram Type Turret Lathe. The hydraulic drive controls operation of the turret and the cross slide and all machine functions, including feeding of the bar stock and opening and closing of the collet chuck.

During each automatic cycle the stock is fed to a turret stop and chucked. The end is chamfered to provide an accurate thread start and a die head machines a Class 3 thread. Ample coolant is provided by the turret coolant distributor. Speed is changed and the die head recocked on an angle iron cam mounted in place of the overhead pilot. With support from the turret, the end closest to the spindle is formed from the front cross slide. A hollow tube on the final turret station catches the part as it is cut off from the rear cross slide. The cycle repeats automatically until new bar stock is needed.



Overhead view of tooling setup required to produce ⅜" Acme adjusting screw. Automatic cycle operation of ram type turret lathe eliminates chance of human error, assures greater uniformity and accuracy, piece after piece. (Inset) 7½"-long, ⅜" adjusting screw.



Floor-to-floor time on the 7½"-long, ⅜" Acme adjusting screw shown is only 1.6 minutes. Operator removes finished part from catcher and keeps replacing bar stock as required. Has plenty of time to handle additional machines or perform other work.

GISHOLT

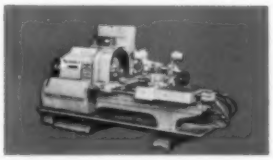
MASTERLINE GISHOLT SINCE 1887

MINNEAPOLIS-HONEYWELL SAVES ON VALVE BONNETS

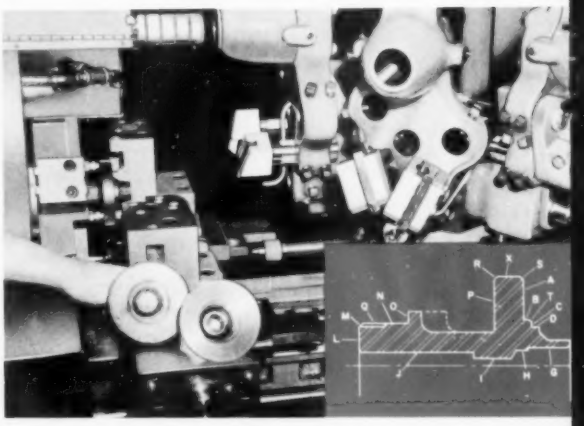
Smart setup includes threading on automatic turret lathe

Here's a setup that improves quality and substantially reduces machining costs on three different sizes of steel valve bonnet forgings at Minneapolis-Honeywell's Fort Washington, Pa., plant. It's done with a Gisholt MASTERLINE 1F Fastermatic Automatic Turret Lathe with a lead screw threading attachment.

Each part is machined in two operations. Smooth hydraulic feed helps achieve a 63 micro-inch finish in the bores at both ends. First operation is on the large flange end of the 5⅜"-high, 4¾"-dia. part. Sequence: chuck on N, locate at P; Hex 1—start drill H, and at the same time face C-E and form D from front cross slide; Hex 2—rough turn X, drill H while rear cross-slide tools face A, shave B; Hex 3—finish turn D-X, rough bore G, chamfer F; Hex 4—chamfer S-T; Hex 5—finish bore G. Time, 2.5 min. f.t.f.



Close-up of tooling for first operation. Note multiple tooling wherever possible to cut time, improve parallelism and concentricity. Rough and first-operation part at left front indicates metal removed. (Above) Finished part showing surfaces machined.



Second operation—Chuck at X, locate at A; Hex 1—start drill J; Hex 2—rough drill J, rough turn N, chamfer R while P is faced from rear cross slide; Hex 3—idle but L-O is faced from front cross slide; Hex 4—drill hole I and flat bottom J, chamfer M, finish turn N; Hex 5—finish end-mill J; Hex 6—thread Q. F.t.f. time, only 5.5 minutes.

Fastermatic's automatic cycle maintains accuracy while automatic selection of proper feeds and speeds prolongs tool life. Threading attachment assures accurate leads and Class 3 threads.

HOW TRANE COMPANY PRE-PLANS...CUTS BALANCING COSTS

This ingenious setup handles a variety of parts

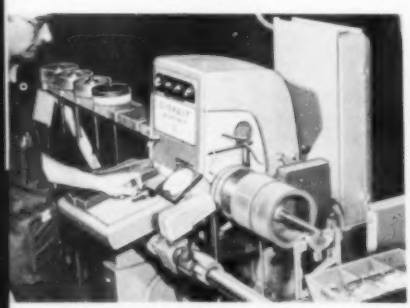
This idea from the Trane Company of La Crosse, Wisconsin, pays big dividends by combining balancing operations for a number of different parts on one machine.

Here a 1S Balancer is set up to balance six different sizes of single- and double-width centrifugal fan wheels for Trane's well-known line of air-conditioning, heating and ventilating equipment. Fan lengths range from 2⅜" to 13⅜₁₆"; diameters from 4" to 12", and weights from 1¾ to 21 lb.

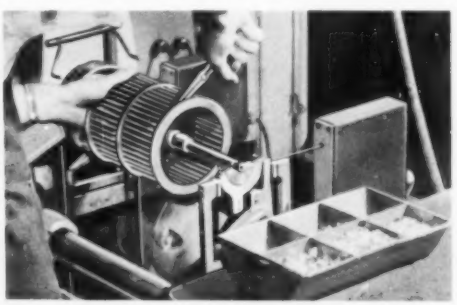
Arbors are used to support, locate and drive. Various sizes of arbors, with angularly graduated pulleys, identified by workpiece numbers, are racked beside the balancer. A simple reference card file guides operator to arbor selection and machine calibration for each part.

Here's a typical operation on an 11-pound, 7" DWDI centrifugal fan wheel. Fan is mounted on correct arbor, placed between work supports, and belt drive applied to the pulley O.D. Operator notes angle and amount of unbalance in two correction planes, and stops part. Then, indexing work to the indicated angles in each correction plane, he matches the observed amount meter readings with the same weight metal clips. The clips are crimped in place on the fan blades to correct unbalance. Part is rotated again to inspect and the operation is complete—in only 1 minute f.t.f.

Switch levers for both left and right correction planes give simultaneous indication of angle and amount of unbalance. Note handy arbor rack at left and tray of correction weights at right.



Operator crimps correction weight clip into place on fan wheel blade. Angularly graduated pulley on keyed driving arbor simplifies location of exact unbalance angle in each correction plane.



Costs are cut by measuring, locating, correcting and inspecting for unbalance in single handling. Pre-planned setup speeds change-over, permits balancing wide variety of parts at top efficiency.

713
No. 9-1058

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

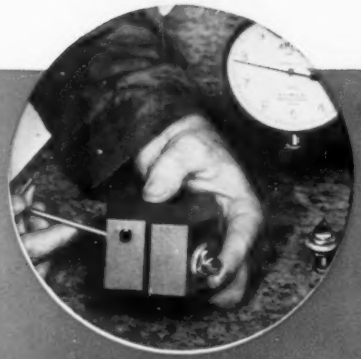
GISHOLT MACHINE COMPANY Madison 10, Wisconsin

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

now, pre-set tools to accurate part dimensions outside the machine with this new Microbore® System

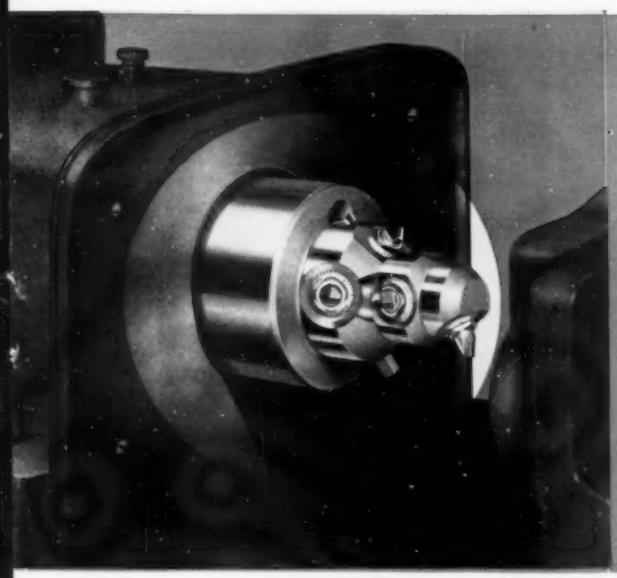
SIMPLE 4-STEP PROCEDURE

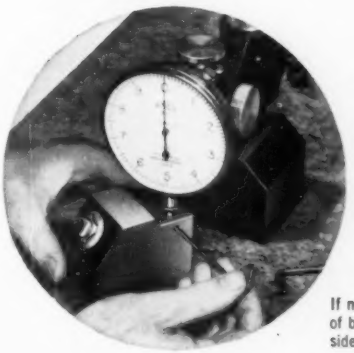
1. To set up pilot tool, insert Microbore "Pre-Set" unit in boring bar. Adjust to part dimension by trial cut and final setting using Micrometer Vernier adjustment.



2. Remove adjusted pilot tool from the boring bar and install in the standard Microbore setting block.

3. Position indicator anvil on high point of pilot tool in setting block and adjust indicator to zero.





4. Adjust gage pin to same zero setting. Any number of additional tools may now be pre-set and interchanged with pilot for precision boring the same diameter.

If necessary to pre-set for depth of bore, tumble block to adjacent side and repeat procedure.

Eliminate trial cuts... change tools in seconds... simplify tool maintenance

Using a standard setting block and indicator, Microbore tools can now be pre-set to accurate part dimensions outside the machine and quickly locked in the boring bar or tool holder without further adjustment.

"Pre-Set" eliminates scrap parts due to trial and error set-up and greatly reduces down time for worn tool point adjustment. "Pre-Set" encourages the operator to keep sharp tools in the machine assuring greater accuracies and produces the maximum number of pieces per tool grind by minimizing breakage due to dull tools.

"Pre-Set" also makes it possible to replace worn tools without changing the entire boring bar or tool holder—eliminates the need for stand-by bars —simplifies tool grinding and maintenance.

Microbore System of "Pre-Set" tooling may be applied to boring, turning, facing and chamfering operations and is especially suited to production and automated operations where machines must maintain peak production on long runs. Write for complete information.

The DeVlieg Microbore System of Adjustable Precision Tooling includes Standard Microbore Boring Bars and Boring Bar Sets, Special Cluster Tooling, Flash-Change Tooling and Tool Holders, Flash-Change Replacement Bridgeport Spindles, Turret Lathe Turning Heads and Adjustable Boring Heads.

DEVLIEG MICROBORE® SYSTEM

DE VLIEG MICROBORE • DIVISION OF DE VLIEG MACHINE COMPANY

Fair Street, Royal Oak, Michigan

Better Saw Blade Performance GUARANTEED by DoALL's built-in quality!

To guarantee the quality of DoALL Saw Blades, they must pass 83 separate control checks made at every step of the way—from raw material analysis to final package inspection. DoALL Saw Blades *must* pass every known test to prove their right to carry the DoALL label—your identification of the finest in saw blades.

Tooth set guaranteed **within a ± .002" tolerance assures accurate sawing . . . longer cutting life . . . uniform kerf size . . . and finest surface finish.**

Sharpest, toughest, most durable teeth **are obtainable only from DoALL's modern technology and exclusive manufacturing processes.**

Shape-engineered gullets **assure smooth, uniform chip flow at faster cutting speeds. Gullet design, developed after photoelastic stress analysis, results in increased tooth strength and greater flex life.**

Controlled tooth hardness **is 61 to 63 Rockwell C for longest cutting life. Uniform tempering of the flexible back insures maximum flex life.**

DoALL makes 18 types of band tools in more than 300 width-pitch-set combinations. Ask for the DoALL Saw Blade Selector Chart. It's free!

The DoALL
Band Tool Guarantee
Every DoALL Band Tool is unconditionally guaranteed to meet all current, published specifications including set, temper, and to be completely free of defects in material, workmanship, heat treating and packaging. Any band not meeting these specifications will be replaced free of charge provided the defective band is returned, prepaid, to DoALL.

IN STOCK
AT YOUR LOCAL DoALL STORE

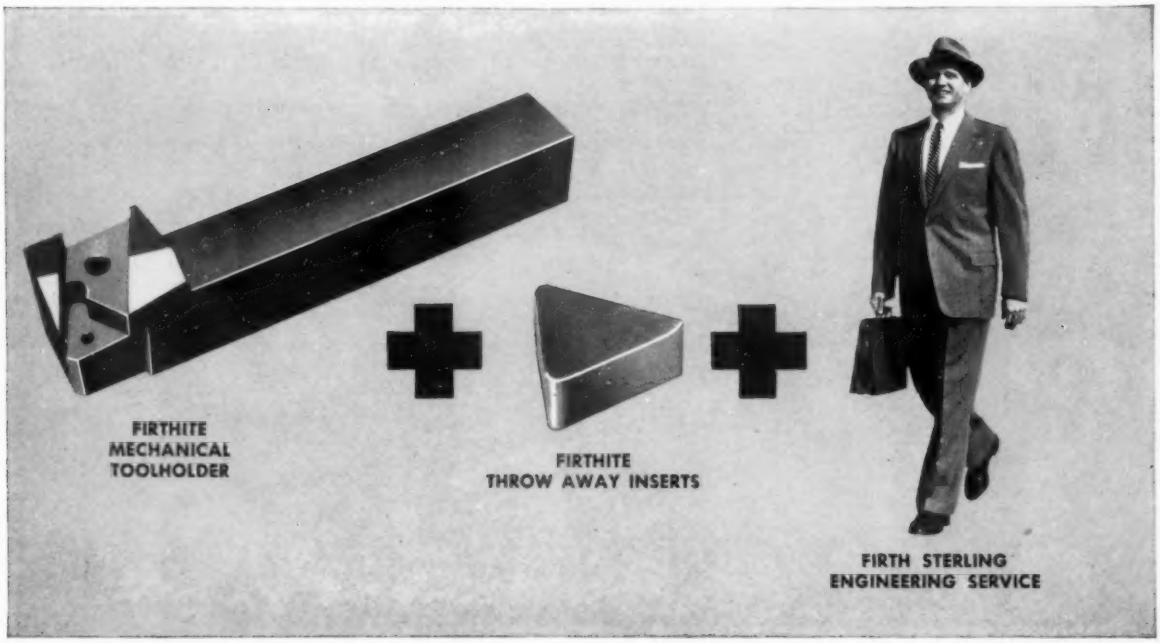
THE DoALL COMPANY
DES PLAINES, ILLINOIS

SB-62

Did you know?
The nation's finest, fastest, most convenient and complete saw blade service is at your local DoALL Store.

Firth Sterling ...

PIONEER IN POWDER AND MOLTEN METALLURGY



TOOL UP FOR ECONOMY

with this cost-cutting combination

There are two important reasons why thousands of metalworking plants are cutting costs with Firth Sterling mechanical toolholders, throw away inserts and engineering service. First, the broad experience and expert application knowledge of Firth Sterling engineers (yours at no cost) help you plan your tooling program for maximum savings. Second, in this complete line, Firth Sterling has toolholders and inserts—*exactly* right for *your* job:

THRIFTOOL—lowest cost toolholder made. Offers chipbreaker, rigid insert and rapid indexing for reduced set-up time.

ECONODEX—medium priced holder is ideal for jobs requiring positive rake. Carbide anvil and carbide chipbreak clamp assure long life.

MECHANIDEX—for heavy-duty machining. Adjustable chipbreaker offers extreme versatility, allowing top and bottom indexing of inserts.

FIRTHITE INSERTS—most precise dimensionally—are available in a full range of Carbide grades and the new Firthite Cermet WF Grade. *Now available for the first time, high speed steel throw away inserts in two of Firth Sterling's top cutting grades—Circle C and Van Chip.*

To get help with *your* tooling problem from a Firth Sterling engineer, simply call your nearest Firth Sterling sales office or distributor. And for further information on Firth Sterling toolholders and inserts, write for descriptive bulletin MTI-3: FIRTH STERLING, INC., Dept. 100, 3113 Forbes St., Pittsburgh 30, Pa. Offices and warehouses in principal cities.

"Your Future is Great in a Growing America"

PRODUCTS OF Firth Sterling METALLURGY

HIGH SPEED STEELS • TOOL & DIE STEELS • STAINLESS SPECIALTIES • HIGH TEMPERATURE ALLOYS
SINTERED TUNGSTEN CARBIDES • HEAVY METAL • CERMETS • CHROMIUM CARBIDES
ZIRCONIUM • TITANIUM • STERVAC & STERCON SUPER ALLOYS

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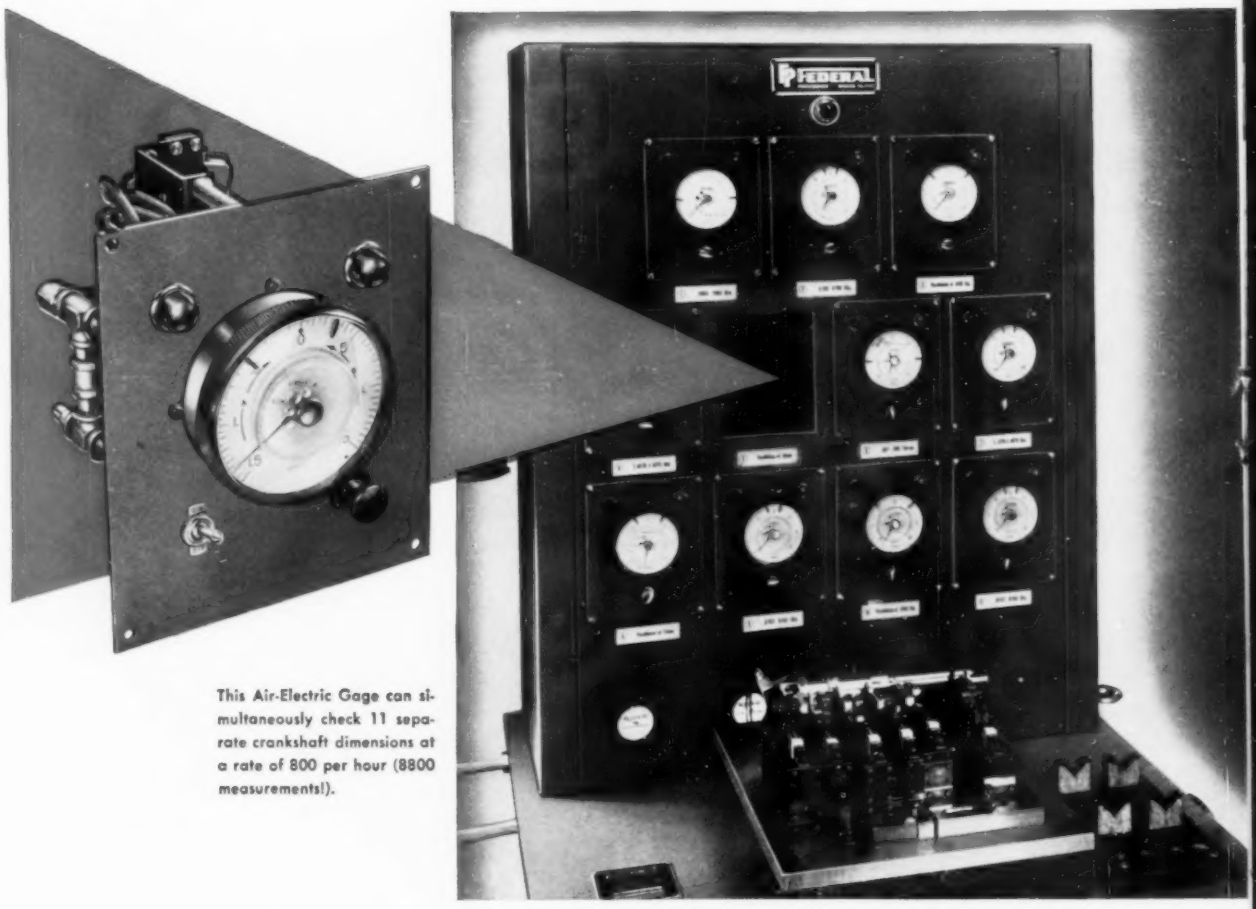
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-23

WHAT A DIFFERENCE

MODULAR DESIGN . . .

Meter switch units are standardized for lower cost and self-contained for quick interchangeability. *Result* — lower gage price, gage downtime virtually eliminated.



This Air-Electric Gage can simultaneously check 11 separate crankshaft dimensions at a rate of 800 per hour (8800 measurements!).

There isn't a production line gage in use that doesn't need care and service. Good design keeps this to a practical minimum. However, few, if any, designs have been aimed deliberately at reducing the amount of time needed to effect service or replacement . . . a critical consideration in production costs. But Federal's MODULAR design arranges construction so that gage downtime is reduced to moments. Only four screws, two finger-tight air hose connections and an electrical connector are involved in replacement of one meter unit by another. Then the replaced unit can be serviced at the bench when convenient. And, with Federal's one-master air system, setting the replacement unit takes only *10 seconds*. Even though the overall gage design is special to suit the particular requirements, these MODULAR units are standardized, which means lower first cost.

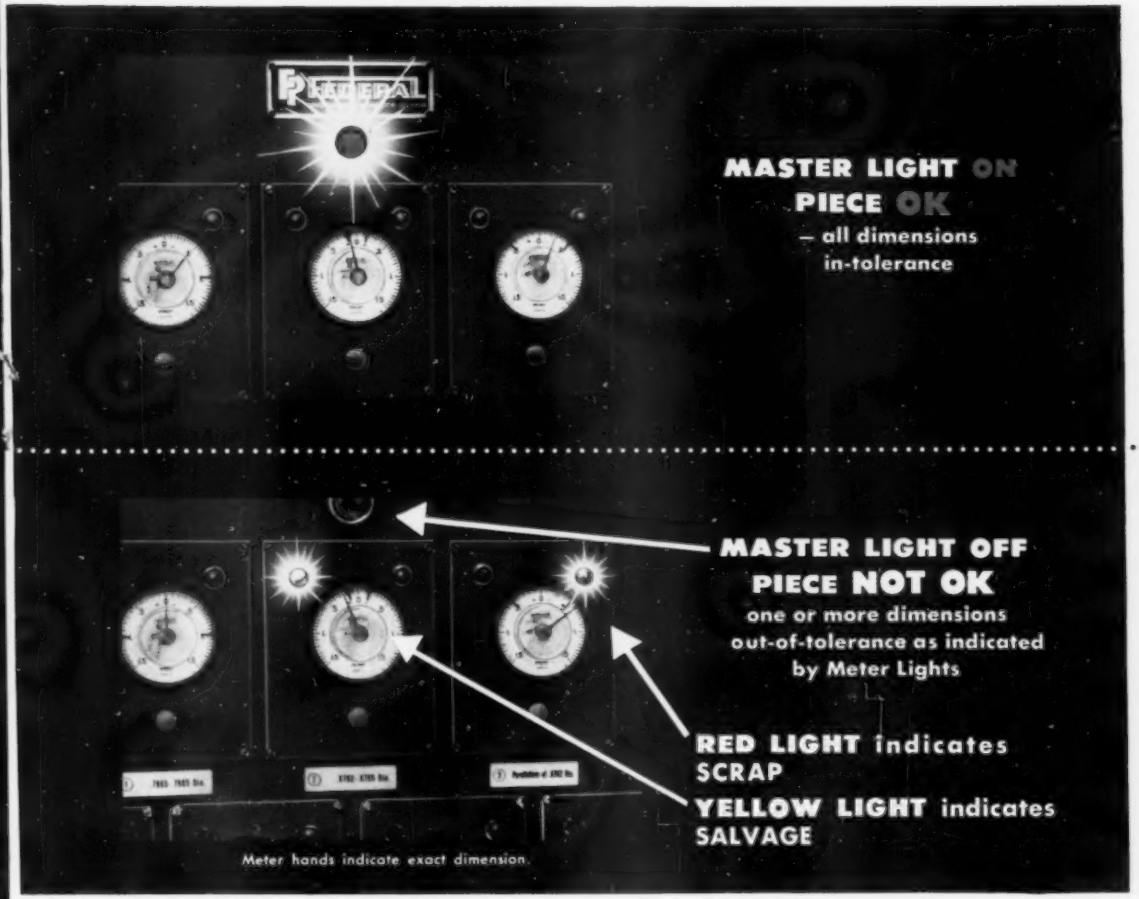
Get in touch with your Federal representative and investigate MODULAR design further . . . in terms of your own needs.

FEDERAL PRODUCTS CORPORATION
8199 Eddy Street, Providence 1, R. I.

IN GAGING ECONOMY!

● MASTER LIGHT CONCEPT...

Lets gage's accuracy, rather than operator's judgment, determine piece acceptability. *Result* — gaging speed doubled, errors eliminated.


MASTER LIGHT ON
PIECE OK
— all dimensions in-tolerance
MASTER LIGHT OFF
PIECE NOT OK
one or more dimensions out-of-tolerance as indicated by Meter Lights
RED LIGHT indicates SCRAP
YELLOW LIGHT indicates SALVAGE
Meter hands indicate exact dimension.

Ordinarily, a multiple dimension gage requires the operator to determine—from scanning a row of bobbins or meters—the dimensional conformance of the piece being gaged. To keep up with the production pace, this must be done quickly . . . often leading to errors, especially in borderline decisions. Also, the fatigue factor in this type of gaging is high, accounting for additional inspection errors.

But Federal's MASTER LIGHT concept eliminates these errors by making acceptability decisions for the operator . . . without hesitation . . . without prejudice . . . without fatigue . . . *without error.* It does more than that, actually. If one or more of the dimensions are "out", the gage spots these and tells the operator instantly whether the piece must be scrapped or whether it can be reworked. Small wonder that this method can increase gaging speed over 100% . . . an increase that can easily mean needing only one gage-operator combination, instead of two, in order to keep pace with production needs.

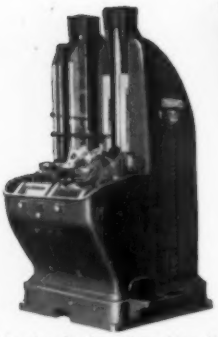
Another advance that means more economy when you do business with Federal. Talk it over with your Federal representative soon.

Ask **FEDERAL** *First*

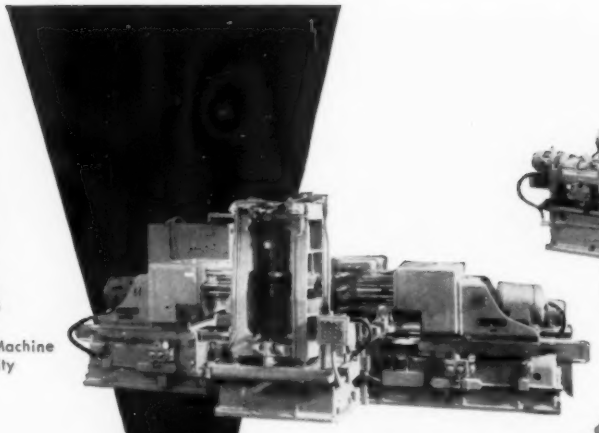
FOR RECOMMENDATIONS IN MODERN GAGES . . .

Dial Indicating, Air, Electric, or Electronic — for Inspecting, Measuring, Sorting, or Automation Gaging

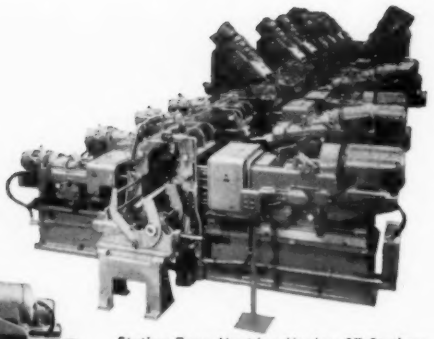
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-25



Duplex Surface Broaching Machine
5, 10, 15 and 25 Ton capacity

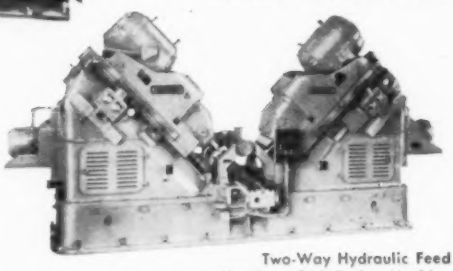


Three Way, 63 Spindle Central System Type, Hydraulic Feed, Horizontal Drilling and Boring Machine with Hydraulically Operated Fixture in Loading Position



Station Type Machine Having 27 Stations, 139 Spindles for Processing a V Type Automobile Motor Cylinder Block

Single Slide Broaching Machine
5, 10, 15 and 25 Ton capacity



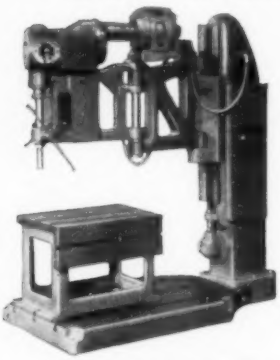
Two-Way Hydraulic Feed Vee Type Stub Boring Machine

FOOTBURT

line of production machines

1, 2, 3, 4 and 6 Spindle Sensitive Drilling Machines

Way Type Drilling, Boring, Reaming, Tapping and Milling Machines with One, Two or More Ways . . . Station Type Machines . . . Center Column Type Machines . . . Cylinder Boring Machines . . . Inverted Drilling Machines . . . Surface Broaching Machines . . . Sensitive Drilling Machines . . . Hammond Radial Drilling Machines . . . Hammond Surface Grinding Machines . . . Manufacturing Type High Duty Drilling Machines . . . Independent Feed Drilling Machines . . Special Machines.



Unique Bracket Type Hammond Radial Drilling and Tapping Machine

Extremely accurate Hammond Tool Room Grinder

Continuous Type Broaching Machine Built in Five Sizes

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: 24632 Northwestern Hwy., Detroit 35, Mich.

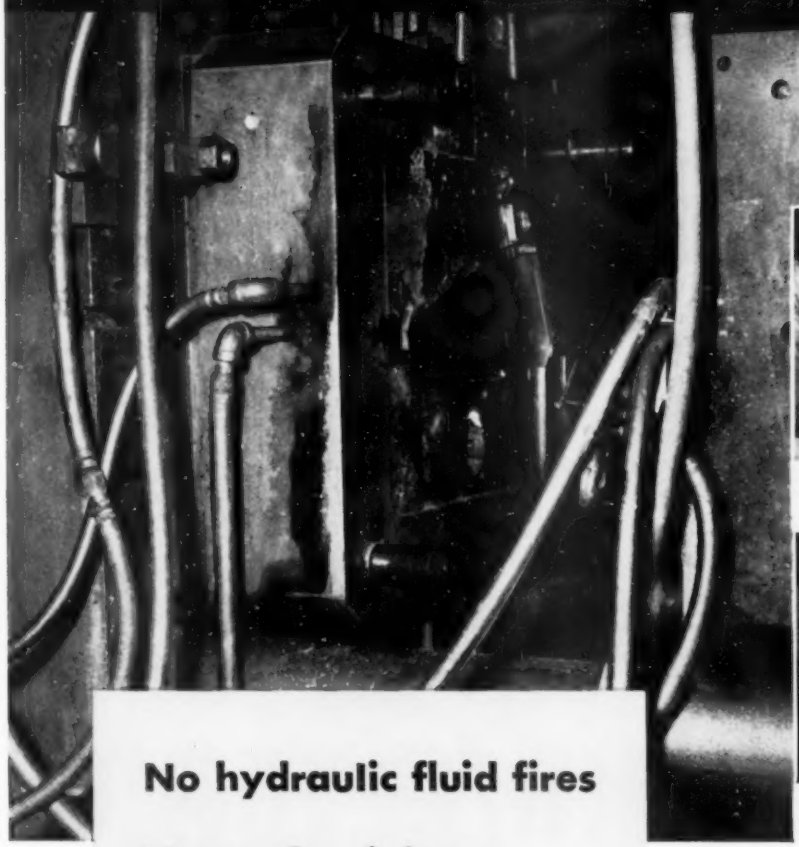
ENGINEERED FOR PRODUCTION

Write for Catalog

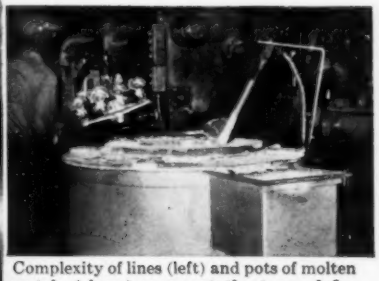
FOOTBURT

MACHINE TOOLS

"For 3 solid years—



Irus Fluid's distinctive yellow color makes it easy to spot and trace leaks.



Complexity of lines (left) and pots of molten metals (above) represent the type of fire hazards requiring Shell Irus Fluid 902.

No hydraulic fluid fires

No worker injury

No equipment damage —since we switched over to SHELL IRUS FLUID 902"

says Ernie Ike, Plant Superintendent
Western Die Casting Co., Emeryville, Calif.

According to Mr. Ike, these results are directly due to the switch-over in 1955 from conventional hydraulic fluids to Shell Irus Fluid 902.

Irus® Fluid 902 is a special combination of petroleum oils mixed with water and emulsifying agents. Its fire resistance is achieved through the relatively high water content. Irus snuffs out fire, *under plant conditions.*

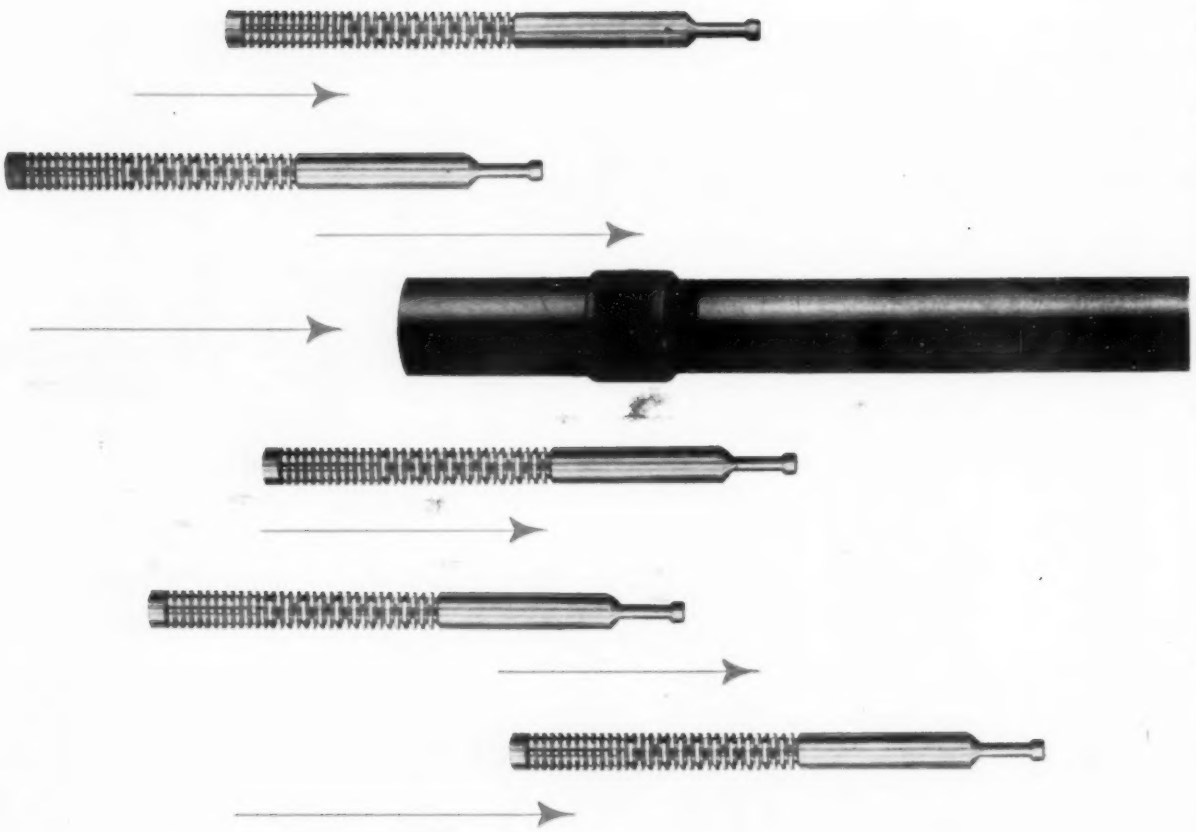
Another important advantage of Irus Fluid 902 is its low cost. Plant operators now using Irus have discovered that Irus Fluid costs up to one-third less than other fire-resistant fluids . . . yet is comparable in performance in every practical respect.

If the hydraulic equipment in your plant is exposed to fire hazards, let a Shell Industrial Representative show you the advantages of Irus Fluid 902. Write Shell Oil Company, 50 West 50th St., New York 20, N. Y. or 100 Bush St., San Francisco 6, Calif.

SHELL IRUS FLUID 902

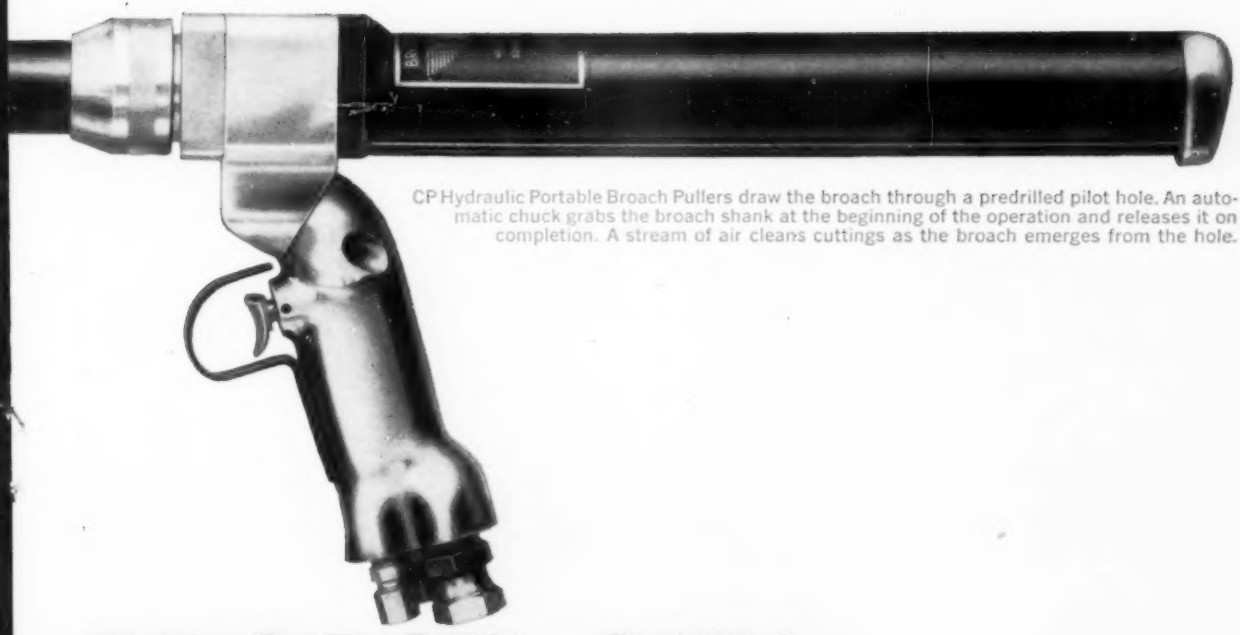
a low-cost, fire-resistant hydraulic fluid

SHELL



CP PORTABLE ...A NEW WAY

Now you can take a 9-pound portable hydraulic tool to the work and finish round holes to tolerances as close as .0002″ in a matter of seconds. This new and highly productive method is preferred over reaming because of its greater accuracy and lower labor and tooling costs. Round holes *are really* round and meet every standard for size, concentricity, squareness of bore axis with face, absence of taper, and bell mouth. In addition, round pilot holes are quickly converted to square, hex, oval, splined or keyed shapes . . . and hole walls are "mirror finished". Capacity: 3/16″ to 5/8″ diameter holes.



CP Hydraulic Portable Broach Pullers draw the broach through a predrilled pilot hole. An automatic chuck grabs the broach shank at the beginning of the operation and releases it on completion. A stream of air cleans cuttings as the broach emerges from the hole.

BROACH GUN...
TO FINISH HOLES

TRY IT YOURSELF AT THE A.S.T.E. WESTERN TOOL SHOW – PIONEER BROACH COMPANY BOOTH 1042, September 29 – October 3.

Chicago Pneumatic

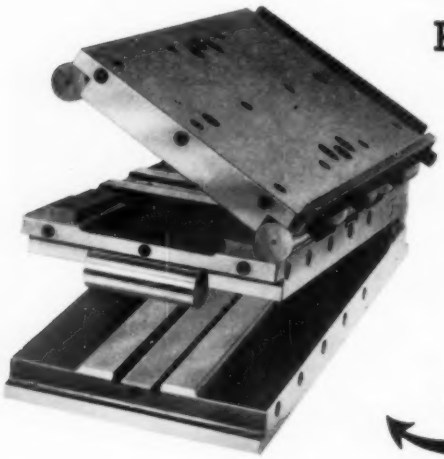
8 East 44th Street, New York 17, N. Y.

CP-805-ARDR Power Cell – Hydraulic power for the Broach Gun is provided by the CP-805-ARDR Pneudraulic Power Cell. This compact, carryable 58-pound unit operates from conventional shop air lines and provides controlled oil pressures up to 7000 p.s.i. for actuating broaching guns and many other types of hydraulic tools.

PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES • ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

NEW!!

ALL THREE ILLUSTRATIONS
ARE THE SAME TOOL

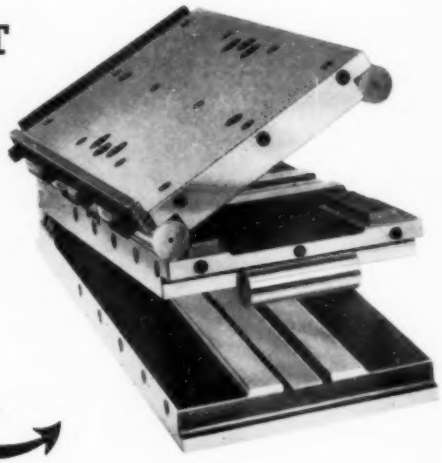


PARAMOUNT
5 x 10 REVERSIBLE

COMPOUND
SINE
PLATE

•

TOP PLATE
will Hinge . . . to the
RIGHT or LEFT



NO MORE SINE PLATE-SET UP PROBLEMS

for checking difficult Right and Left hand Compound Angle parts.

You simply move two allen head cap screws from one side to the other and the Top Plate will open in opposite direction. Complete directions for changeover are packaged with every unit.

$515.00
IN LEATHERETTE
FELT LINED CASE
WITH CHUCK $650.

FEATURES:

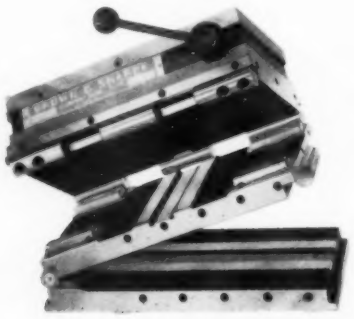
Mat. 1018 mild steel.

Fully case hardened to 50-55 R. C. and artificially aged.

.100 recess under block rolls for setting of small angles.

Accuracy .0003.

End and side rail can be screwed to top service to pinpoint working area.



Two clearance holes for ¼-20 cap screw drilled and counter drilled from under part of Top Plate makes Brown & Sharpe Permanent Magnet Chuck #510-1 adaptable to this sine plate.

PATENTS APPLIED FOR

Either angle can be locked shut.

No screw clearance holes in block rolls to interfere with blocks.

¼ - 20 threads top, ends and sides.

Clamping Lip on both ends.

Work surface 5¼ x 10¼. Height 3⅛".

Weight 50 lbs. without chuck.

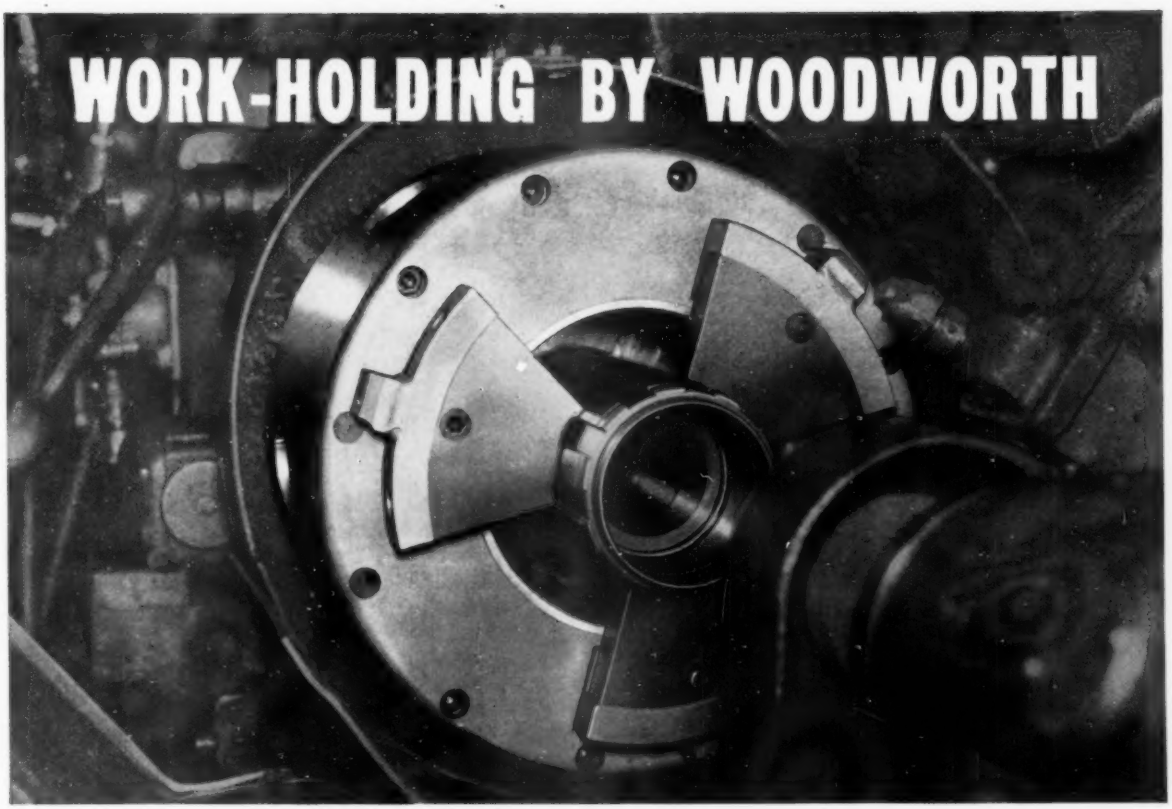
On Display Aaron Machine Company Booth 800 Western ASTE Show

PARAMOUNT TOOLING CO.

A COMPLETE LINE OF STANDARD & SPECIAL SINE TOOLS

6116 Clara Street — Bell Gardens, California — TOpaz 9-0226

WORK-HOLDING BY WOODWORTH



WOODWORTH CHUCKS INCREASE PRODUCTION BY 50%

CLARK GEAR SUPERINTENDENT REPORTS

ROY COPELAND

- **ROY COPELAND,** *Superintendent of the Gear Division, Clark Equipment Company, Jackson, praised the outstanding performance record of Woodworth Double Diaphragm Chucks: "These chucks have proved more adaptable and accurate than others since they insure repetitive chucking with a minimum of eccentricity. In the Gear Division we have realized 50% greater productivity through the use of Woodworth Chucks."*

- **The WOODWORTH DOUBLE DIAPHRAGM CHUCK** (shown above), with jaw inserts manufactured by in-plant personnel at Clark Equipment Company, chucks a quill shaft in two locations on the O.D. In this operation on a 72 Heald Size-matic Internal Grinder, the I.D. is ground to .0008" tolerance. The overall length of the part is 10" and between .005" and .006" of stock is removed. Concentricity of .002" T.I.R. is maintained between the ground external spline and three ground inside diameters in three separate chucking operations.

WRITE FOR CHUCK CATALOG 3-58

When You Buy, Specify

ACCURACY YOU CAN TRUST

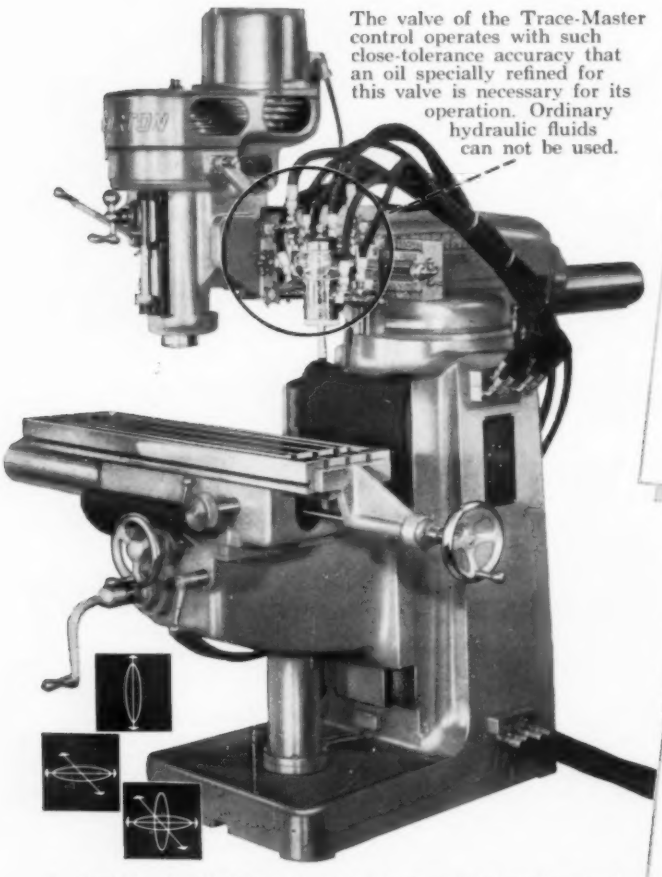
WOODWORTH

1300 EAST NINE MILE ROAD • DETROIT 20, MICHIGAN

Designed for the *"Missile Age"*

GORTON "Trace-Master" Mastermil

with exclusive combination of sustained toolroom accuracy and precision-built Trace-Master Hydraulic tracer control



The valve of the Trace-Master control operates with such close-tolerance accuracy that an oil specially refined for this valve is necessary for its operation. Ordinary hydraulic fluids can not be used.

Nowhere Else will you find this combination

1. TWO H.P. spindle motor
2. Finest Milling Head in its class
3. 80 to 5,600 RPM spindle speeds
4. Rigidity . . . (2,800 lbs net weight)
5. Extra long saddle

Nowhere Else will you find this versatility

1. Production profiling
2. Scanning
3. Duplicating . . . die and mold work
4. Milling . . . conventional and climb
5. Boring

3 Models Available (1) 180° Vertical Hydraulic Feed to Knee (2) 360° Cross Hydraulic Feed to Ram and Longitudinal Hydraulic Feed to Table (3) 3D Hydraulic feed to knee, ram and table for 3-dimensional work.

Trace-Master controls can be furnished with the Model 1-22 Mastermil illustrated above or the Model 9-J Super-Speed Vertical Mill with single spindle, twin spindles and/or six inch higher column for additional vertical capacity.

Write for Bulletin 2771-2609

GORTON

GEORGE GORTON MACHINE CO.

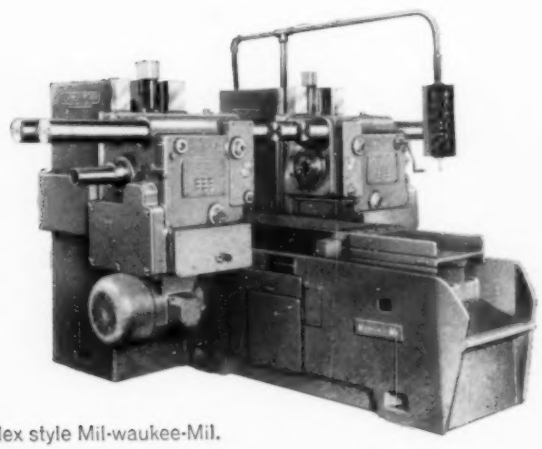
2609 Racine Street — Racine, Wisconsin

SINCE 1893

Tracer-Controlled Pantographs, Duplicators — standard and special . . . Horizontal and Vertical Mills, Swiss-Type Screw Machines, Tool Grinders, Small Tools and Accessories.

CORE DRILLS
48-Hour Service
on carbide tools ground to specified diameters
Send us your order—*Within 48 hours* we will ship stock solid or expansion reamers and core drills ground precisely to your specified special diameters by skilled Staples craftsmen. Staples maintains a full line of these high-quality, carbide reamers and core drills to insure fast shipment of tools modified to your special needs.
Write for information on the complete line of Staples Precision Carbide Tools.
PROMPT QUOTATIONS ON ALL SPECIAL TOOLS
EXPANSION REAMERS (Patented)
Staples
ROTATING CARBIDE TOOLS
THE Staples TOOL COMPANY
2352 Glendale-Milford Road,
Cincinnati 15, Ohio
SOLID CHUCKING REAMERS

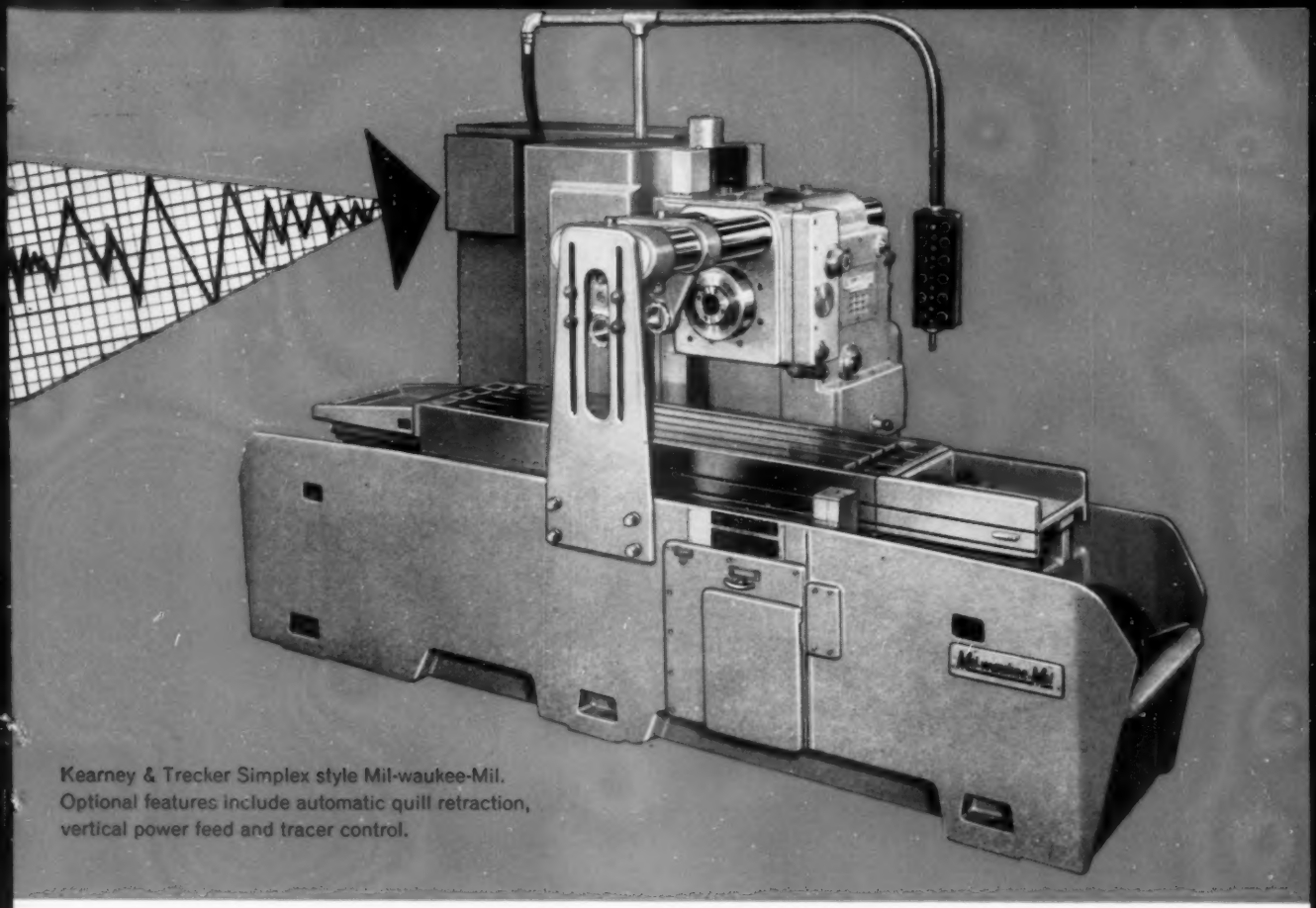
*first **dial** your results from the blueprint . . .*



Kearney & Trecker Duplex style Mil-waukee-Mil.

Designers and Builders of Precision and Production Machine Tools Since 1898

KEARNEY & TRECKER
MILWAUKEE
®



Kearney & Trecker Simplex style Mil-waukee-Mil. Optional features include automatic quill retraction, vertical power feed and tracer control.

then get programmed production ***automatically***
with the NEW ***Kearney & Trecker***

Mil-waukee-Mil® BED TYPE

PRODUCTION MILLING MACHINE

- ***dial-a-cycle*** **panel programs and controls each and every machine function . . . automatically!**
- **Interrupt or resume cycles at any time without returning to "start" position!**
- **Change from *dial-a-cycle* automatic control to manual with the flip of a switch!**
- **Choose from 72 standard models . . . Simplex and Duplex . . . 7½ to 30 hp.**

Fast, pre-phased setups slash idle cutter time — dramatically boost finished workpiece production. Do it on this remarkable new Kearney & Trecker Mil-waukee-Mil programmed production milling machine.

Operator simply dial-programs machine function into the ***dial-a-cycle*** control panel. No guesswork! He merely reads workpiece blueprint and establishes machining sequence with successive phase-switch dials.

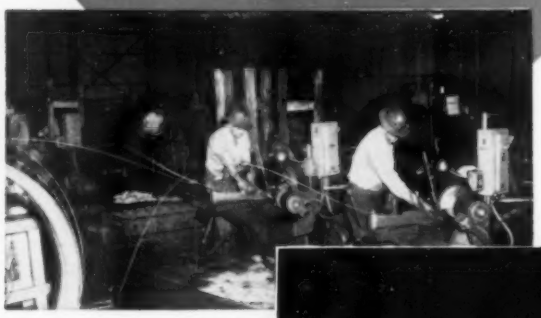
Free Bulletin MM-58 —

Kearney & Trecker Corp., 6772 West National Ave., Milwaukee 14, Wisconsin.

BATH

Taps and Gages help to build the * World's longest suspension bridge!

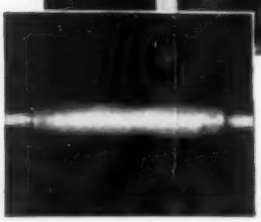
41,200 miles of wire suspends the Mackinac Bridge superstructure — constructed by American Bridge Division, United States Steel.



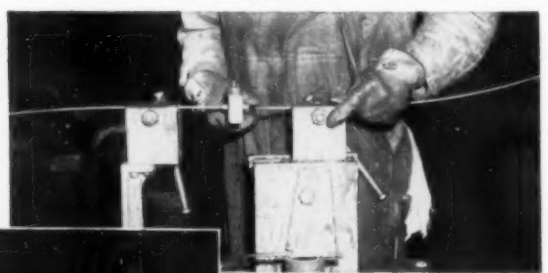
Each end of the coil of wire is fed to machines where one cuts a right and the other a left hand thread, both ends being mitered.

Photo-courtesy Contractors & Engineers magazine.

Right and left hand thread prior to splicing. Photo — courtesy Mackinac Bridge Authority.



The two ends are joined by a coupling. Photo — courtesy Mackinac Bridge Authority.



Joining two coils is accomplished by bringing the right hand thread of one wire and the left hand thread of the other together, where a coupling device draws the ends tight until the mitered ends fit to prevent turning in the coupling. The continuous wire is wound on huge reels for spinning equipment on the bridge . . . about 70 coils to a full reel of 16 tons (320,000 feet or over 60 miles of wire).

Photo — courtesy Contractors & Engineers magazine.

This majestic bridge represents a veritable monument to precision . . . with no detail too small for perfection.

The use of Bath special tools and dies to thread this wire for joining into strong, consecutive lengths of cable is proof of Bath engineering ability and high manufacturing standards.

Whether it's a small but important part of a big job — or a big part of a small job . . . you'll find Bath gages, taps and special tools are designed to guarantee controlled measure of component parts wherever accuracy is essential.

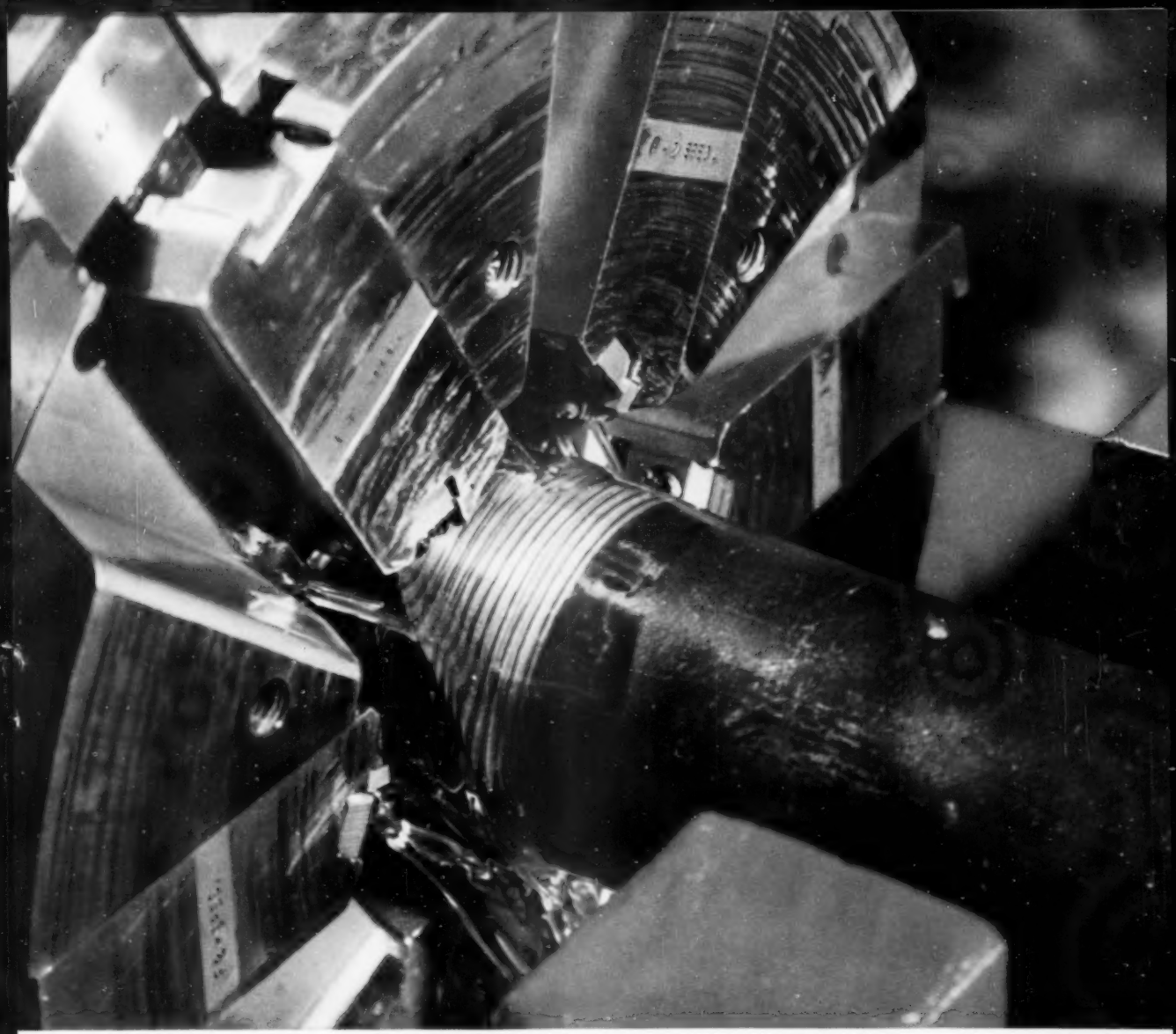
JOHN BATH & CO. Inc.

28 Mann St., Worcester, Mass.

CYLINDRICAL AND THREAD GAGES • GROUND THREAD TAPS
INTERNAL MICROMETERS

* INTERESTING FACTS

Wires per strand	340
Strands per cable	37
Number of cables	2
Total wires in each cable	12,580
Weight of superstructure	66,500 tons
Length of suspension bridge (including anchorages)	8,614 ft.



This is just one of the many applications of Sunicut 85, which is one of a whole series of Sunicuts . . . all transparent.

SUNICUT 85 is a heavy-duty cutting oil that lets you see what you're doing

Transparent, fast-draining Sunicut® 85 leaves the workpiece clear for inspection as you go.

Especially designed for use on high-alloy steels, Sunicut 85 is ideal for heavy-duty work on automatic screw machines and production form grinders. It's a natural for pipe threading and similar heavy-duty operations requiring frequent and close inspection.

Easy pumping, fast metal-wetting, and excellent extreme-pressure lubrication are other advantages of Sunicut that lead to production economy for you.

Ask your Sunoco representative about saving money with Sunicut, or write to Dept. I-10.

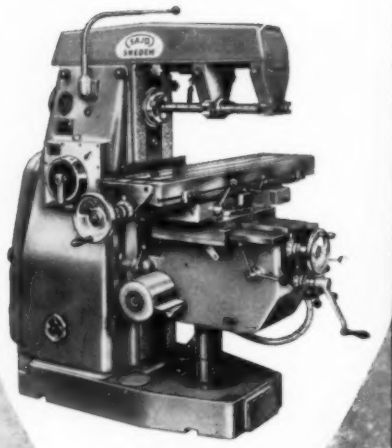
Industrial Products Department

SUN OIL COMPANY, Phila. 3, Pa.

SUNOCO

© 1958 SUN OIL COMPANY

In Canada: Sun Oil Company Limited, Toronto and Montreal



SAJO Horizontal
Miller Model 54

**We can't turn back the calendar, but—
you can buy SAJO Millers today at the same price
you paid for a comparable machine tool in 1949.**

Time stood still...

Produced by Sweden's master craftsmen, these modern machine tools are engineered to maintain precise tolerances in continuous heavy-duty production. An example is the unique SAJO spindle construction employing SKF precision 2-row staggered roller bearings followed by thrust ball bearings, providing better load distribution and silent, vibration-free operation.

Built to U. S. standards, SAJO Millers are recognized for their accuracy, dependability and long life.

Condensed specifications:

table 52″ x 11″
longitudinal movement 33½″
16 spindle speeds, 39-1500 r.p.m.
American Standard Taper No. 50
main drive motor 7½ h.p.
feed motor 1½ h.p.

Accessories:

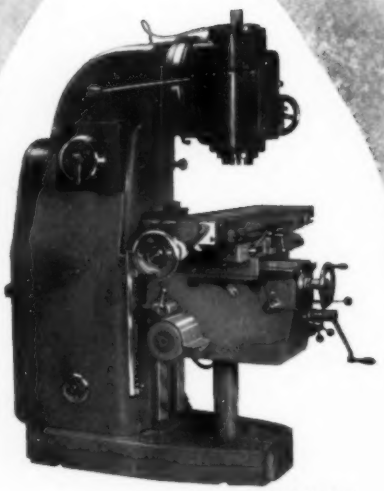
Universal Dividing Head, Rotary Index Table, Vertical and Universal Milling Attachments, Slotting Attachment, Vises, Arbors.

Also available:

SAJO Plain and Universal Millers, table size 41½″x 9¼″.

Here are "hindsight" opportunities for foresighted machine tool buyers.

Write for literature and references in your area.



SAJO Vertical
Miller Model 54

austin
industrial
corporation

76-V Mamaroneck Avenue, White Plains, N. Y.

HORIZONTAL AND VERTICAL SHAPERS—POWER HACKSAWS
Fast Service and Parts Available from Major Cities

Side-Thrust Resistance "BUILT-IN"*

STANDARD'S DOUBLE-END END MILLS

The STANDARD Line:—
Twist Drills
Reamers
Taps . . . Dies
Milling Cutters
End Mills . . .
Counterbores
Carbide Tools
Gages
Hobs

* Engineering Experience . . . and Design "Know-How". . . PLUS . . . Quality Controlled Materials . . . BIG FACTORS that

make STANDARD'S Double-End End Mills durable, rugged and accurate performers when rough milling jobs are the assignment.

STANDARD'S 77 years of experience and the STANDARD Man in your area are available to help and advise in the selection of *the right cutting tool* for your metalworking problems.

The STANDARD Distributor in your area stocks a complete line of rotary metal cutting tools.

A POINT TO REMEMBER . . . when you buy STANDARD'S Quality you buy economy.

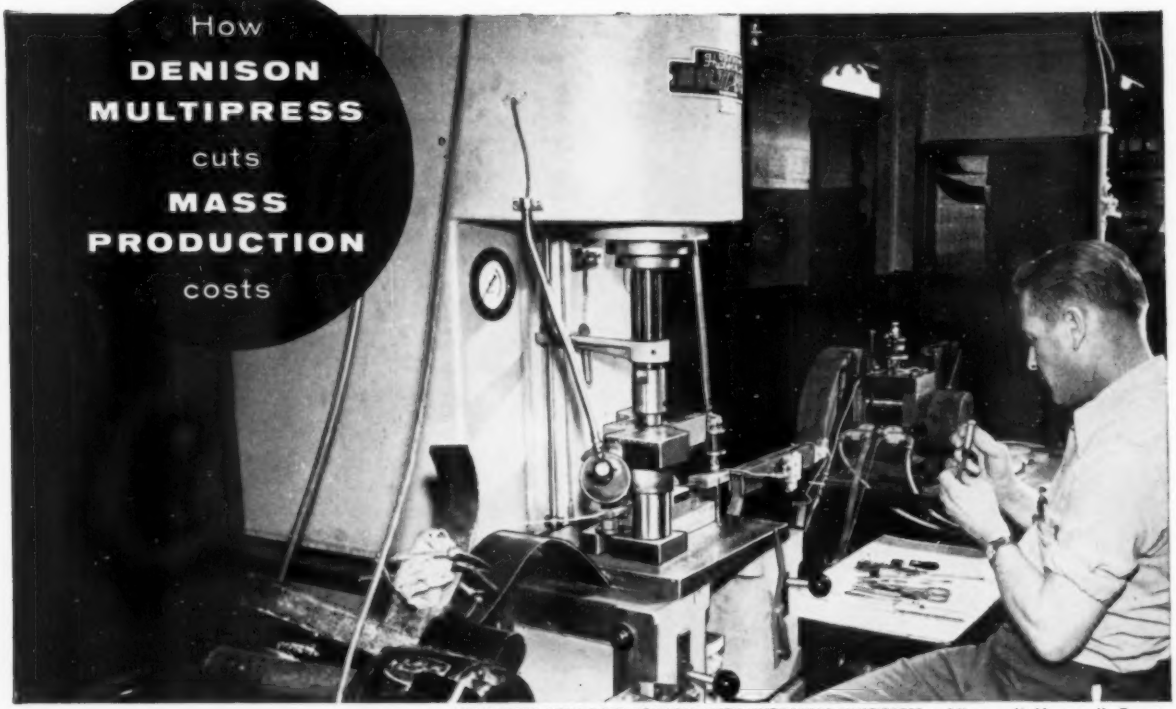
Quality Tools Since 1881

STANDARD TOOL CO.

3950 CHESTER AVENUE CLEVELAND 14, OHIO

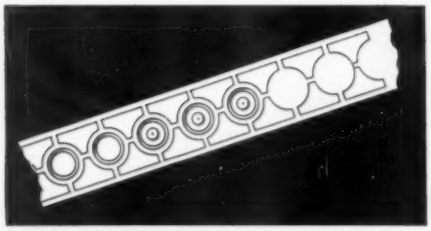
BRANCH WAREHOUSES IN: NEW YORK · DETROIT · CHICAGO · DALLAS · LOS ANGELES · SAN FRANCISCO

How **DENISON MULTIPRESS** cuts **MASS PRODUCTION** costs

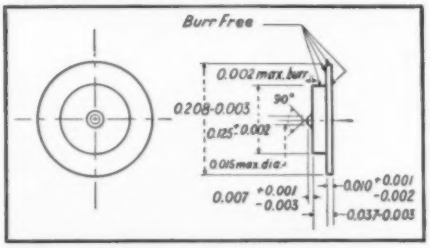


HIGH-SPEED LOW-COST COINING WITH HYDRAULIC MULTIPRESS at Minneapolis-Honeywell. Operating at 225 strokes-per-minutes, modified 8-ton Denison Multipress turns out 70,000 magnesium buttons a day. Automatic controls and safety limit switches permit one operator to handle 3 Multipress lines.

How **DENISON** *hydraulic* Multipress saves cash on high-speed coining for **MINNEAPOLIS-HONEYWELL**



3-STAGE PROGRESSIVE DIE advances strip .4375" with each ¾" Multipress ram stroke. Holes are used for piloting—and for stock advance with hitch feed.



EXTRUDED, COINED AND BLANKED from pure magnesium strip—this button is mass-produced at *extremely low cost* on Multipress. Stock sizing rolls control thickness of strip fed to die. *Denison hydraulic Multipress controlled pressure easily holds necessary precision tolerances.*

High-speed coining of small magnesium buttons is normally a mass production job for an automatic screw machine. *But, Minneapolis-Honeywell found it could do the job better and faster... save money, too... with Denison hydraulic Multipress.*

A modified 8-ton Multipress—equipped with 3-stage progressive die, 6-ton cylinder and special high-speed valves—mass produces about 70,000 of these ordnance-item buttons per 8-hour shift. Coining and blanking the buttons from coiled strip stock with Multipress—instead of using bar stock and a screw machine—*cut costs significantly on the operation.*

The progressive Multipress die—designed by Minneapolis-Honeywell engineers—has 3 working stations. *First station* pierces triangular holes which relieve strip and permit proper impact extrusion. *Second station* extrudes and coins parts to size—but leaves them intact in the strip. *Third station* blanks parts and moves them through the blanking die into waiting containers.

This is typical of hundreds of jobs that Denison Multipress does today throughout industry... to give users the *competitive edge.*

Denison hydraulic Multipress means important *plus benefits,* too—longer tool and die life... less scrap... better quality control... minimum maintenance... greater operator safety.

Isn't it time *you* got the story on Multipress...complete line from 1 to 75 ton capacities. Call or write your Denison Hydraulic Specialist on your very next job.

DENISON ENGINEERING DIVISION
American Brake Shoe Co.
1182 Dublin Road • Columbus 16, Ohio

Denison, Denison HydrOILics, and Multipress are registered trademarks of Denison Eng. Div., ABSCO

Denison Stocking Branch Offices: LOS ANGELES • CHICAGO
DETROIT • ATLANTA • NEWARK • CLEVELAND • HOUSTON

DENISON HydrOILics

HYDRAULIC PRESSES • PUMPS • MOTORS • CONTROLS

BUTTERFIELD
100%
INSPECTED
TOOLS

the complete line

Butterfield offers you everything you want in cutting tools...when you want them...wherever you want them. Drills, reamers, taps, dies, counterbores, cutters, end mills, hobs and carbide tools. Warehouses in Chicago, Cleveland, Detroit, Fort Worth, Los Angeles, New York and San Francisco. *See your Butterfield Distributor.*

BUTTERFIELD

BUTTERFIELD DIVISION, UNION TWIST DRILL COMPANY, DERBY LINE, VERMONT

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-41

Now—FINISH FLAT

New Norton 6" x 18" Surface Grinder Ready For Immediate Delivery

You FINISH FLAT FASTER with the new Type S-3 hydraulic which is equally efficient for long production runs or a wide variety of toolroom grinding because of its new cost-cutting features. It produces plane surfaces smoothly — with automatic or manual cross feed and with such fast, cool-running action that it saves time and money on every job.

Ask your Norton Representative for the whole story. Or write us direct for Catalog 2128. And remember: only Norton Company offers you such long experience in both grinding machines and grinding wheels to bring the "Touch of Gold" that helps you produce more at lower cost. NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

Profit from these benefits

1. Get Jobs Done Fast and Cool — high table speed, *125 feet per minute, maximum.* **2. Handle Tall Work Pieces** — greater vertical capacity, *15"*. **3. Get Lasting Accuracy** with guide-rail cross slide construction. **4. Control Vertical Feed Accurately and Position Fast** with two-speed .0001" increment hand wheel. **5. Benefit from Better Sighting and Loading** due to contoured splash guards. **6. True Forms, Even on Worn Wheels** because of recessed wheel spindle housing.

To Economize, Modernize with **NEW**

NORTON

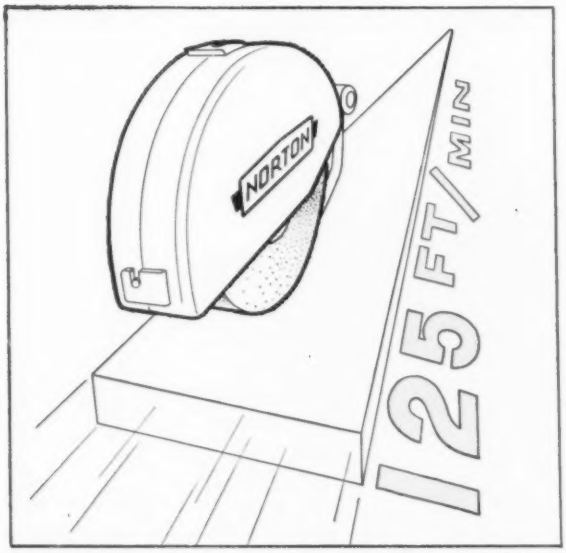
GRINDERS and LAPPERS

Making better products... to make your products better

NORTON PRODUCTS
Abrasives • Grinding Wheels • Grinding Machines
Refractories • Electrochemicals
BEHR-MANNING DIVISION
Coated Abrasives • Sharpening Stones
Pressure-Sensitive Tapes
District Offices
Worcester • Hartford • Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

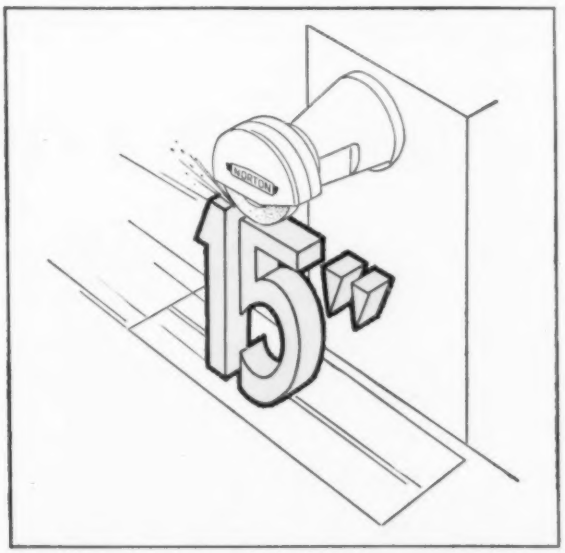
FASTER.... at lower cost

These and many other new features make this machine a "must" for your surface grinding jobs.

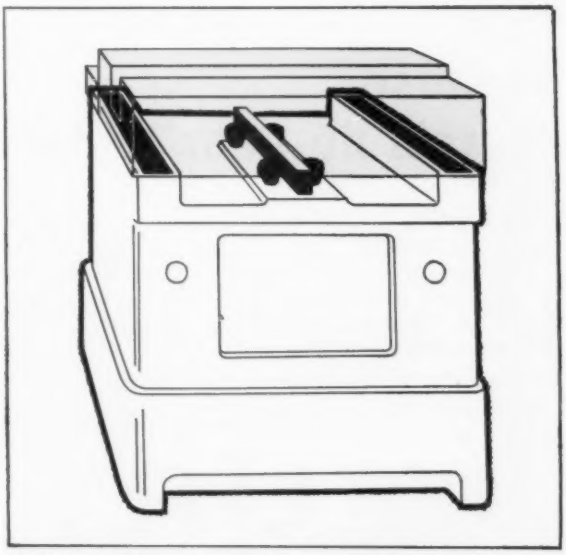


Finish flat faster, cut grinding time and increase production, with high table speed, 125 feet per minute.

Heat goes off in the chips, due to new, high table speed. This cooler grinding permits faster production on heat-sensitive metals.



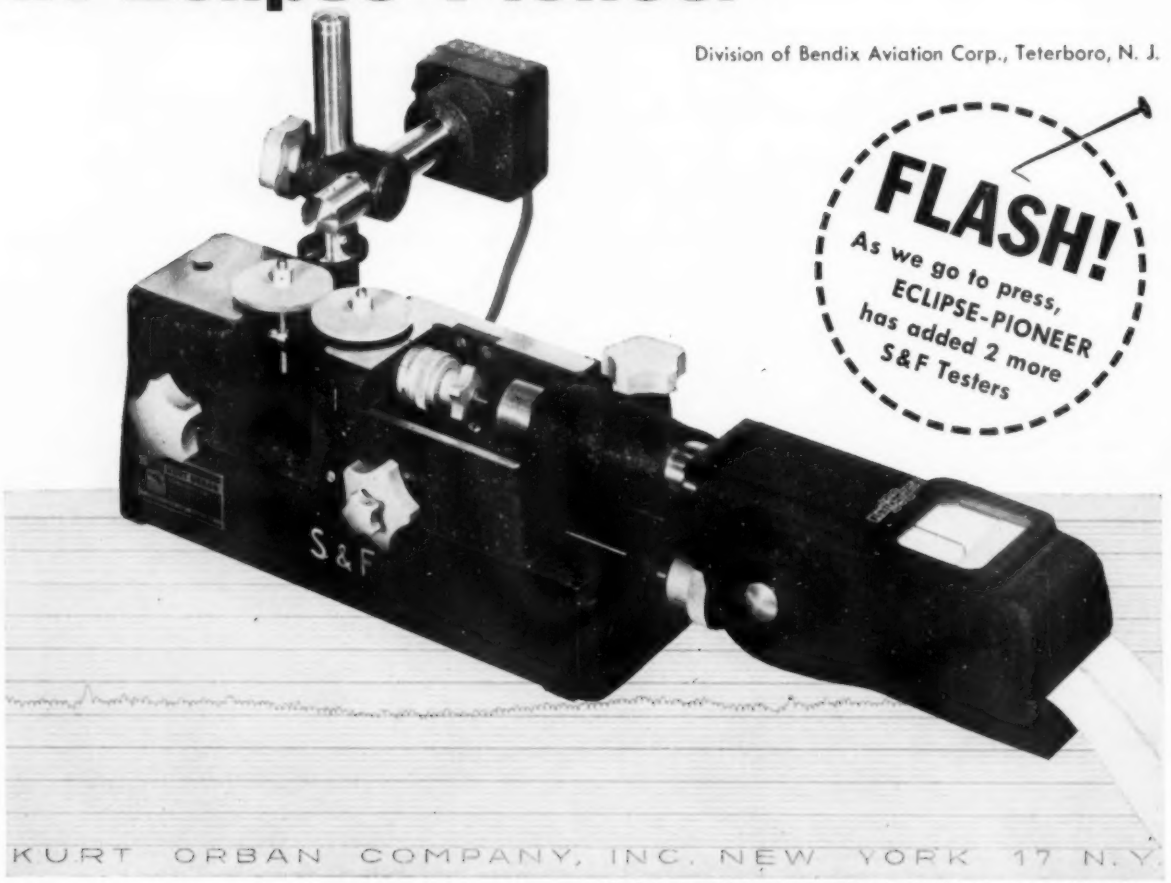
Handle taller work pieces with high-grind wheel head construction. The vertical capacity from the table top to the bottom of standard full size 8" diameter grinding wheel is 15"



Widely spaced, flat ways and guide-rail cross slide design maintain cross feed accuracy, providing lastingly accurate grinding of shoulders or parallel surfaces.

now it's 13 S&F gear testers at Eclipse-Pioneer

Division of Bendix Aviation Corp., Teterboro, N. J.



FLASH! As we go to press, ECLIPSE-PIONEER has added 2 more S&F Testers

Graphotest record of gear checking at Eclipse-Pioneer illustrates sensitivity of S & F Testers.

because there's no gear tester as accurate as the S & F

Gear specifications for Eclipse-Pioneer's directional gyros call for Precision Class 3 tolerances—tooth-to-tooth error of .0002", total composite error of .0003".

Eclipse-Pioneer found that the S & F provided the *extra* measure of sensitivity which assured that their gear production *really* held to these tolerances. It did the job faster, too. Set-up and change-over time was only a fraction of what it had been with other instruments.

That's why Eclipse-Pioneer recently added three new S & F testers—now has a total of 13 in active operation.

And that's why scores of other plants are changing over to the S & F—to make sure that the gears they make—or buy—are as accurate as they're supposed to be.

Ask us to show you why the S & F—*guaranteed to repeat within .00001"*—is revolutionizing gear checking. Or talk to the S & F user near you; we'll send you his name.

KO CO., INC. PRECISION MACHINERY

KURT ORBAN COMPANY, INC.

Harborside Terminal Building, Jersey City 2, New Jersey

Production time reduced 82% on new lathe

PROFIT POINT TURNING

New Barber-Colman 36-speed lathe does 13 operations on drive gear and shaft in 22.7 minutes

Turning time on the drive gear and shaft shown in the illustration was reduced from 126 minutes to 22.7 minutes when transferred from an old lathe to a new Barber-Colman 36-speed lathe.

The shaft is 15″ in length with a maximum diameter of 3.744″. Spindle speeds range from 644 rpm to 912 rpm, and the feed is .013″ per revolution. On the old lathe, speed was 350 rpm and the feed was .015″ per revolution. This is a good example of how machine horsepower, accuracy, rigidity, and operational features can reduce costs drastically.

Easy-to-set up Barber-Colman lathes combine power and precision for profitable optimum speed turning with negative-rake throwaway insert tools. They're heavier and wider through the carriage than most lathes of their size. Controls are "human engineered" to make a busy operator's job easier and more efficient. Yet they offer every toolroom feature you can name, plus guaranteed accuracy for precision work.

STANDARD TIME	OLD LATHE	NEW 36-SPEED LATHE
SETUP TIME (hours)	1.09	1.75
SPEEDS (rpm) FEED (inches per rev.)	350 .015	644 to 912 .013
PRODUCTION (per hour)	0.47	2.64

Opportunities in cost-cutting modernization

There'll never be a better time to buy a new lathe, or greater opportunities to reduce costs through equipment modernization. Here are two good reasons:

1. *Throwaway insert tools* are the biggest "break-through" in lathe "economics" in 30 years. Think of what it costs you to sharpen, change, and reset conventional tooling! Throwaway inserts make your perishable tool costs so low in relation to part costs and the cost of operating a machine, the only sensible thing to do is boost speeds, burn up tools faster, and reduce floor-to-floor time.

2. *It's the right time to buy machine tools,* because you can "pick and choose" — get the right machine and tooling for your assortment of jobs. The increase in productivity will prepare your plant for periods of high volume, spiraling costs, and labor shortages tomorrow.

Now in production in two sizes, these new machines will pull 25 hp through the spindle and operate at speeds up to 2000 rpm.

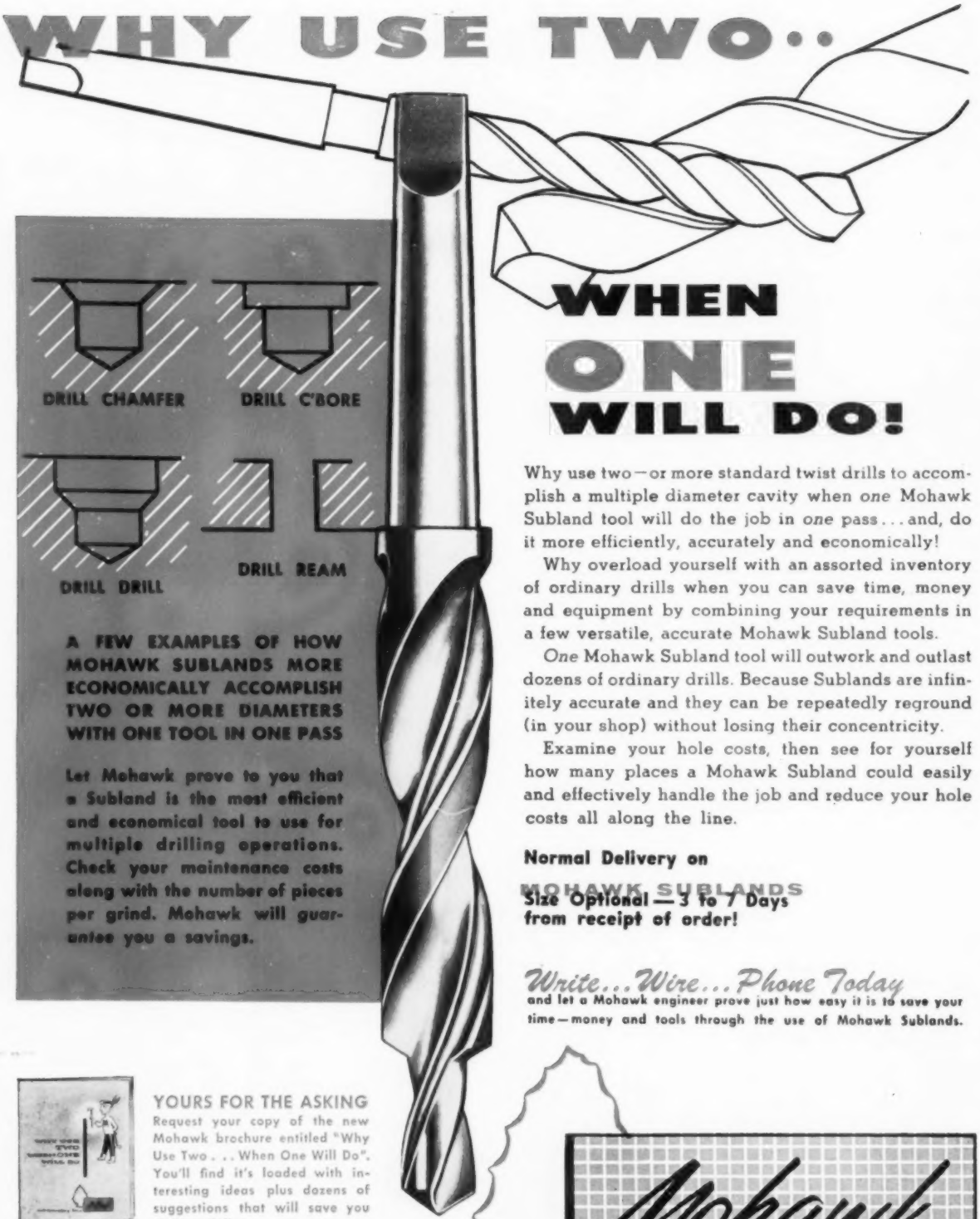
Barber-Colman Company
93 Loomis Street, Rockford, Illinois

Don't expect a day's work for a day's pay on yesterday's machine tools.

BARBER COLMAN®

PRECISION LATHES

WHY USE TWO··



A FEW EXAMPLES OF HOW MOHAWK SUBLANDS MORE ECONOMICALLY ACCOMPLISH TWO OR MORE DIAMETERS WITH ONE TOOL IN ONE PASS

Let Mohawk prove to you that a Subland is the most efficient and economical tool to use for multiple drilling operations. Check your maintenance costs along with the number of pieces per grind. Mohawk will guarantee you a savings.

WHEN ONE WILL DO!

Why use two—or more standard twist drills to accomplish a multiple diameter cavity when *one* Mohawk Subland tool will do the job in *one* pass . . . and, do it more efficiently, accurately and economically!

Why overload yourself with an assorted inventory of ordinary drills when you can save time, money and equipment by combining your requirements in a few versatile, accurate Mohawk Subland tools.

One Mohawk Subland tool will outwork and outlast dozens of ordinary drills. Because Sublands are infinitely accurate and they can be repeatedly reground (in your shop) without losing their concentricity.

Examine your hole costs, then see for yourself how many places a Mohawk Subland could easily and effectively handle the job and reduce your hole costs all along the line.

Normal Delivery on MOHAWK SUBLANDS
Size Optional — 3 to 7 Days from receipt of order!

Write . . . Wire . . . Phone Today
and let a Mohawk engineer prove just how easy it is to save your time—money and tools through the use of Mohawk Sublands.

YOURS FOR THE ASKING
Request your copy of the new Mohawk brochure entitled "Why Use Two . . . When One Will Do". You'll find it's loaded with interesting ideas plus dozens of suggestions that will save you drilling dollars.

world's largest producers of Sublands

Mohawk TOOLS, Inc.
Montpelier, Ohio

★ Useful though uncommon

★ Easy to cut

Tapered gears, although not commonly used, offer a number of advantages when you have a design problem requiring an angular relationship between gear shafts. Production is no problem because, with the proper fixtures, tapered gears can be cut rapidly and economically on a Fellows Gear Shaper.

The tapered gear is simply one whose axis is at an angle to that of the conventional spur or helical gear with which it meshes. If the two axes are at right angles, the "tapered" gear becomes a face gear. If the axes are parallel, it is an ordinary cylindrical gear.

As a result of the use of tapered gears in an aircraft engine, an article giving basic formulae and design considerations was written by a Fellows engineer and published in 1948. Increased interest in this type of gear has since resulted in a number of other applications in machine tools, marine drives, speed reducers and missile projectors.

Because of this increased interest, reprints of the article, "Designing Tapered Gears," are being made available. If you would like a copy, simply write to our main plant in Springfield, Vermont.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices:
1048 North Woodward Ave., Royal Oak, Mich.
150 West Pleasant Ave., Maywood, N. J.
5835 West North Avenue, Chicago 39
6214 West Manchester Ave., Los Angeles 45

THE PRECISION LINE

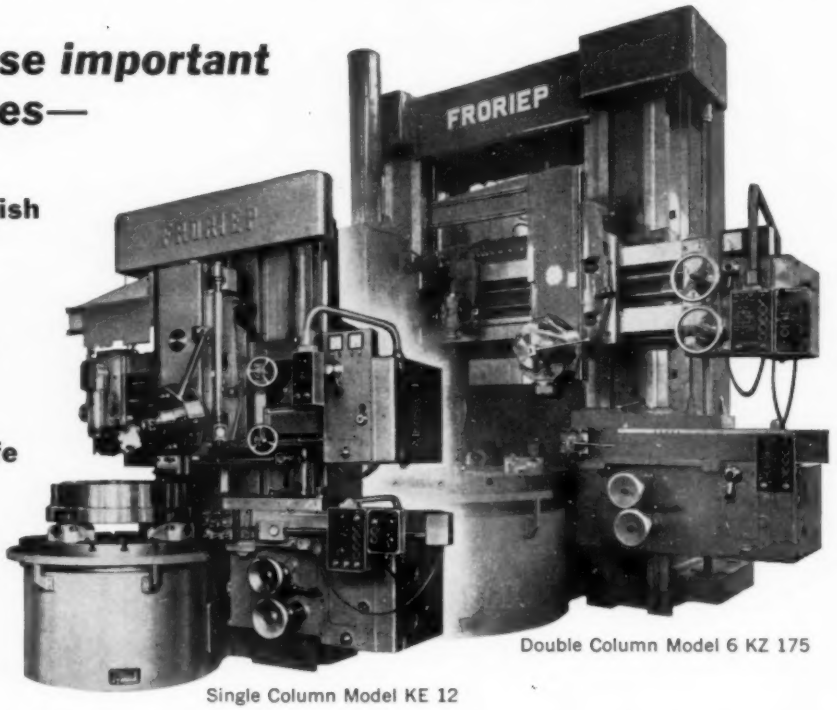
Fellows *Gear Production Equipment*

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-47

Constant Cutting Speed on FRORIEP Vertical Boring Mills

Provides these important advantages—

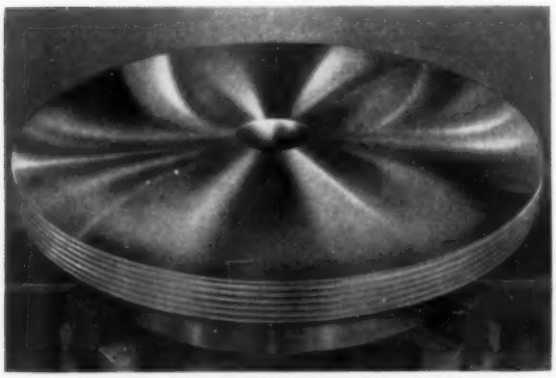
- **Equal surface finish over the entire facing range**
- **Greatly reduced cutting time**
- **Increased tool life**
- **Less down time**



Double Column Model 6 KZ 175

Single Column Model KE 12

Electro-magnetic clutches on a FRORIEP let you maintain constant cutting speed—regardless of decreasing diameter. By a remote electric control you can change quickly to any available speed—without stopping the table. You can adapt table revolutions instantly to the most economical cutting speed for any diameter. If desired, speed can also be set to change automatically, gradually increasing as cutter moves toward the center—and without interrupting the cut.



Uniform surface finish produced by a Froriep

Simple, conveniently placed push buttons and switches control feeds and rapid motion of turret, cross rail and side arm. Cross rail head and side arm operate independently with 12 pre-selected feeds each.

An electric tracer attachment will copy 90° in and 90° out, reproducing almost any shape but undercuts. Automatic tripping devices and combined taper-turning and threading attachment add even more versatility.

Capacities Available Single column models provide a choice of table diameters from 40″ to 63″; double column models from 69″ on up. Special designs also available on request.

Write For More Information

COSA — *nationwide sales and service of precision machine tools—from bench lathes to boring mills.*

COSA CORPORATION, 405 LEXINGTON AVENUE, NEW YORK 17, N.Y.

TWO *New* STARS on the *Super* STAGE

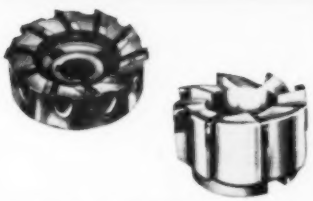
Brilliant Performers Join the Original Carbide Tool Line

New solid carbide single flute countersink #CS and center lap #CL.

Solid carbide flute section increases rigidity, eliminates chatter. Sharpening is by face grinding only. #CS has 82° taper, #CL has 60°. Available in 3/8", 1/2", 3/4" diameters, all 1/4" shanks. #CS available to order with 60° taper.

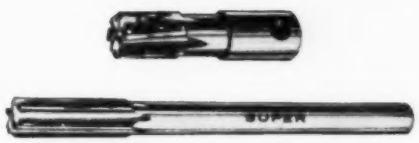
Instead of usual carbide tipped flutes, solid flute section provides much greater strength, less chatter, longer cutting life, less danger of breakage. Costs less than full length solid carbide construction. #RCS, fractional sizes 1/4" to 3/4". #RCB, decimal sizes .230" to .760", ground to specifications.

New straight shank carbide chucking reamer, #RCB and #RCS, with solid carbide flute section.



Milling cutters now in stock with premium carbide grades.

Standard and special carbide single point bits —turning, facing, threading, boring.



Reamers, all types. Stub screw machine and carbide tipped shown.

Carbide tipped and solid carbide twist drills, straight and tapered shanks, every type and purpose.

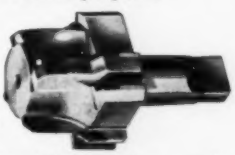
End mills, straight and spiral flute, solid and carbide tipped; for aluminum, iron, steel and other materials.

SEND FOR NEW COMPLETE CARBIDE TOOL CATALOG

Super TOOL COMPANY

Special carbide tools for every high production purpose. Pilot reamer shown.

Special face mill.



Form milling cutter.

For maintenance departments and construction field we also supply Core Vent and Speed Spiral masonry drills and tile and glass drills.

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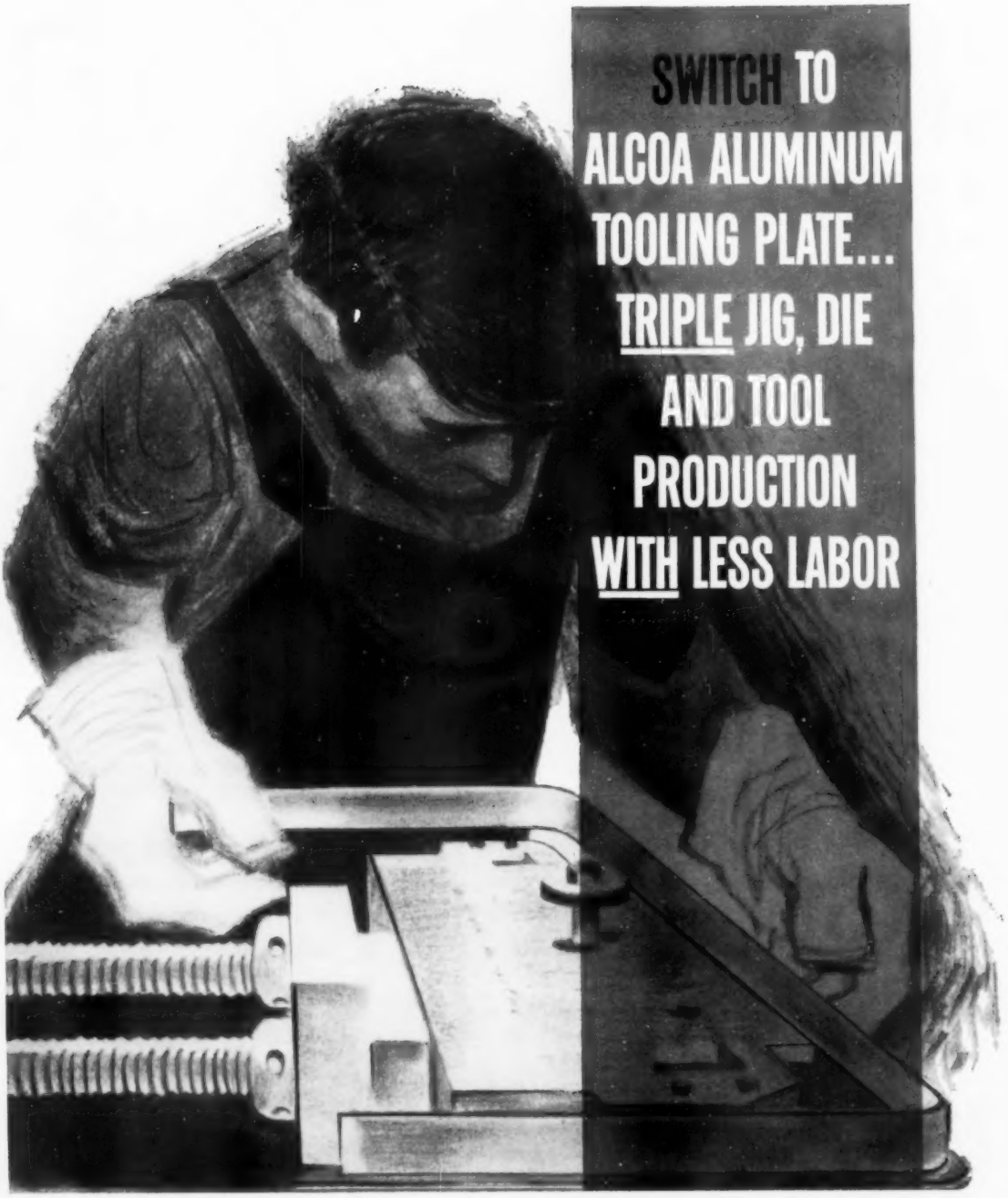
WAREHOUSES: CHICAGO • DETROIT • NEW YORK • LOS ANGELES

Division of Van Norman Ind., Inc.



That's a mighty big order for any shop, but Alcoa® Aluminum Tooling Plate and Alcoa Tool and Jig Plate can fill it. Here's a case in point. You can make three times as many core blower plates from 100 pounds of Alcoa Tool and Jig Plate as compared to the number obtainable from 100 pounds of conventional tooling plate. Now add these other savings: aluminum machines three times faster with better accuracy . . . machines and tools last longer . . . less maintenance is required.

Slash Labor Costs as Much as 60 Per Cent. Along with aluminum's high-speed machining characteristics, you get all-important light weight for savings in handling. Because it weighs but one-third as much as iron or steel, changeovers are reduced to a one-man job. An aluminum jig takes less time and work to open, close, move, store or set up.

Call Your Local Alcoa Distributor. Order locally from a wide selection of sizes and gages, cast or rolled. Alcoa Tool and Jig Plate is ideal for high-precision tooling needs. Alcoa 6061-T6 Tooling Plate is a wrought aluminum plate for high-strength utility requirements.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

Aluminum Company of America
950-J Alcoa Building, Pittsburgh 19, Pa.

only *Lapmaster* would guarantee a flatness of ±.00005″ on parts weighing 4920 lbs.

Proper functioning of this vital missile tracking equipment required the highest degree of accuracy obtainable in flatness and parallelity on several component parts . . . some of unusual weight and size. Of all the precision machine tool manufacturers asked to submit recommendations and quotations, only the Lapmaster Division of Crane Packing Company would guarantee to meet the tolerances.

Handling large and odd shaped parts was not new to the Lapmaster. Standard Model 84 Lapmasters had long been lapping to flatness within three light bands (.000035″) on large castings. Therefore only a few modifications to the standard Lapmaster 84 were required to take care of the 4920 lb. 84″ diameter weldment (see job data).

This job also required a machine with the versatility to handle a variety of small parts as well as the big ones. This customer found—as hundreds of users have—that size, shape or form is no problem to a Lapmaster.

On any job—flatness of the lap plate is continuously maintained by the patented reconditioning action of the conditioning rings.

INVESTIGATE the possibilities and advantages of machine lapping in your plant. Whether you have a problem of flatness and finish on parts the size of this 4920 lb. giant or pieces ½″ in diameter there's a Lapmaster to do the job. Write for the latest Lapmaster technical bulletins.

JOB DATA

THE PARTS: Several component parts of a tracking antenna for a long-range radar system. Largest was weldment weighing 4,920 lbs. and measuring 84″ in diameter with bearing lands of 48″ O.D. x 46″ I.D. and 14″ O.D. x 12″ I.D. (see photo).

THE SPECIFICATIONS: Flatness and parallelity had to be held to ±.00005″ with bearing lands lapped on the same plane. Faces on mating part are also being lapped to the same specifications.

THE MACHINE: Standard Lapmaster Model 84 equipped with an 85″ O.D. x 10″ I.D. lap plate. Special roller bar with simple mountings and fixtures to control position of the odd shaped parts during lapping.

Lapmaster® ... THE MACHINE THAT PUT PRECISION LAPPING ON A PRODUCTION BASIS ...

A product of **Crane Packing Company**
6469 OAKTON STREET, Morton Grove, Ill. (Chicago Suburb)
In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

Weldynamics

ARC WELDING AT WORK CUTTING COSTS

Completely automatic welding . . . guided by hand with the "Mechanized Squirt Welder"

Here's how you can get the speed and sureness of automatic welding . . . plus portability and versatility never before heard of in submerged arc welding.

Mechanized gun is propelled at any preset speed while electrode and flux are fed from an all day supply on the compact, portable control unit.

- Accurately controlled speeds from 1 to 70 inches per minute.
- Flux and wire supplies allow many hours of continuous welding.
- Guides in any direction without fixtures.
- Deep penetration of submerged arc welding.
- Easy to make beautiful welds.
- High operator appeal—light gun, no helmet.

TRIGGER — *Single trigger starts and stops flux flow, wire feed, and welding current.*

SPEED CONTROL AND REVERSING SWITCH — *Speed control dial calibrated in inches per minute. Can be changed while welding. Reversing switch determines direction of travel.*

TRAVEL MOTOR AND DRIVE WHEEL—*Propels gun in any direction at desired speed.*

MOTOR MOUNT—*Travel motor easily adjusted up or down to control flux coverage and rotated around the gun to change travel direction. Control wire coupling disconnects for quick removal of entire travel mechanism for manual operation.*

FLUX — *Granular flux feeds through tube from tank on control unit to small reservoir on gun. Flows from gun by gravity as needed.*

ELECTRODE—(5/32" or 3/16")—*Feeds continuously from 60 lb. coil in control unit through extra flexible cable.*

PORTABLE CONTROL UNIT (*not shown*)—*Contains arc voltage and inching speed controls as well as meters for welding current and voltage. Unit also mounts 60 lb. coil of electrode and tank for over 100 lbs. of flux. Entire control system operates on 115 volt AC power.*

The World's Largest Manufacturer of Arc Welding Equipment

LINCOLN

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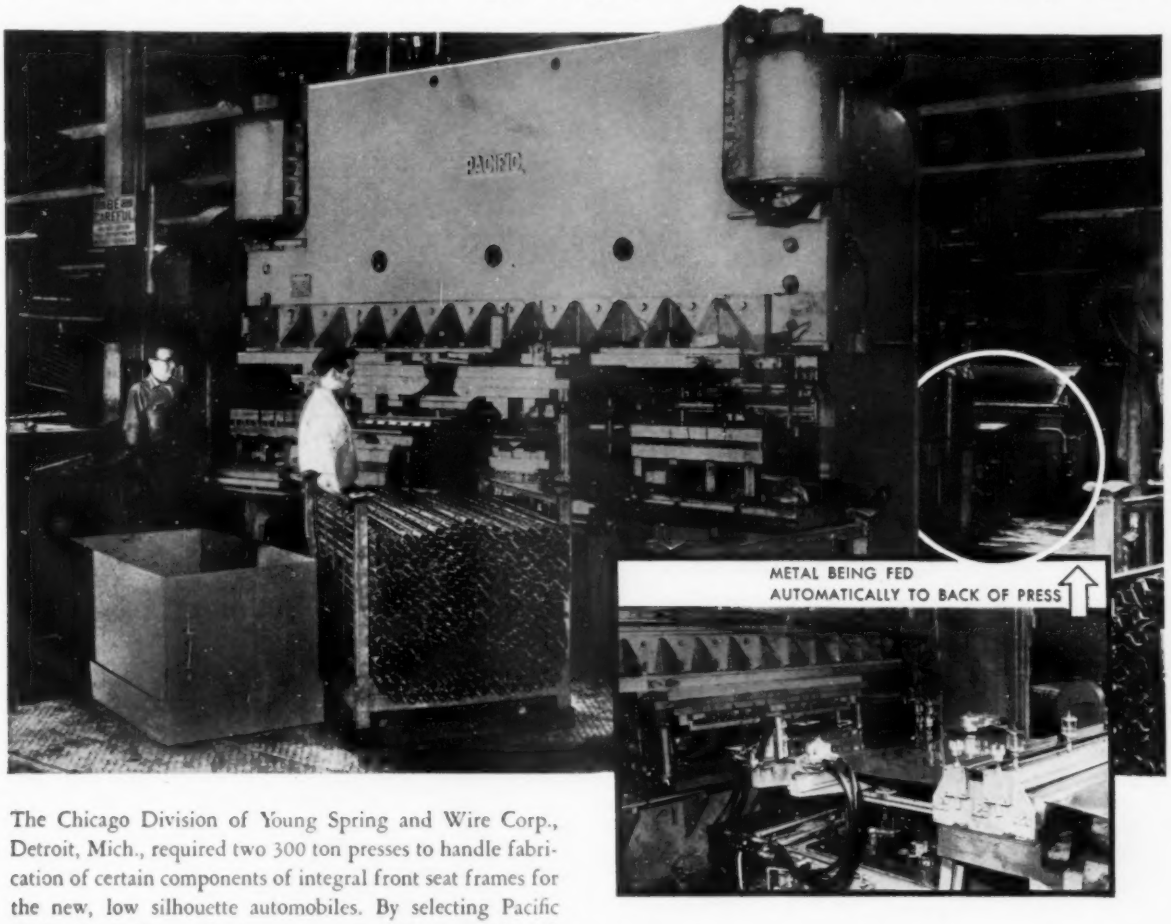
THE LINCOLN ELECTRIC COMPANY, Dept. 5022, CLEVELAND 17, OHIO

Hydraulic press brake reduces machinery and operational costs for forming large, heavy metal stampings



The Chicago Division of Young Spring and Wire Corp., Detroit, Mich., required two 300 ton presses to handle fabrication of certain components of integral front seat frames for the new, low silhouette automobiles. By selecting Pacific Hydraulic Brakes and using progressive dies coupled with an automatic material feeding system, it became possible to form major components of seat frames at each stroke of press. In a one-man operation, the first press stamps and forms the rear rail . . . the major component of the seat frame . . . from 57½" width material automatically fed through a 9-station progressive die from the back of the press to the front. The second press with two 4-station dies flattens and forms the ends of tubular material used for front seat, split-backs. Hydraulic system holds ram momentarily at the work to distribute tonnage evenly as punches enter material. Pressings are noiseless and extremely accurate.

Pacific Hydraulic Brakes actually cost less than conventional presses for this work. Pacific is a versatile tool profitable for any plant, large or small. It pays for itself from operational savings in blanking, forming, deep drawing, embossing, punching, straightening, stretching, extruding, hot forming or shearing. There is a Pacific Hydraulic Press Brake of the correct size to suit your needs.

Write for brochure

PACIFIC INDUSTRIAL MANUFACTURING COMPANY

PACIFIC HYDRAULIC BRAKE

848 49th AVE., OAKLAND, CALIF.
PLANTS:
OAKLAND, CALIF. and MT. CARMEL, ILL.

DISTRIBUTORS:

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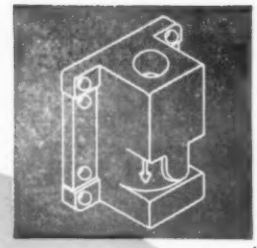
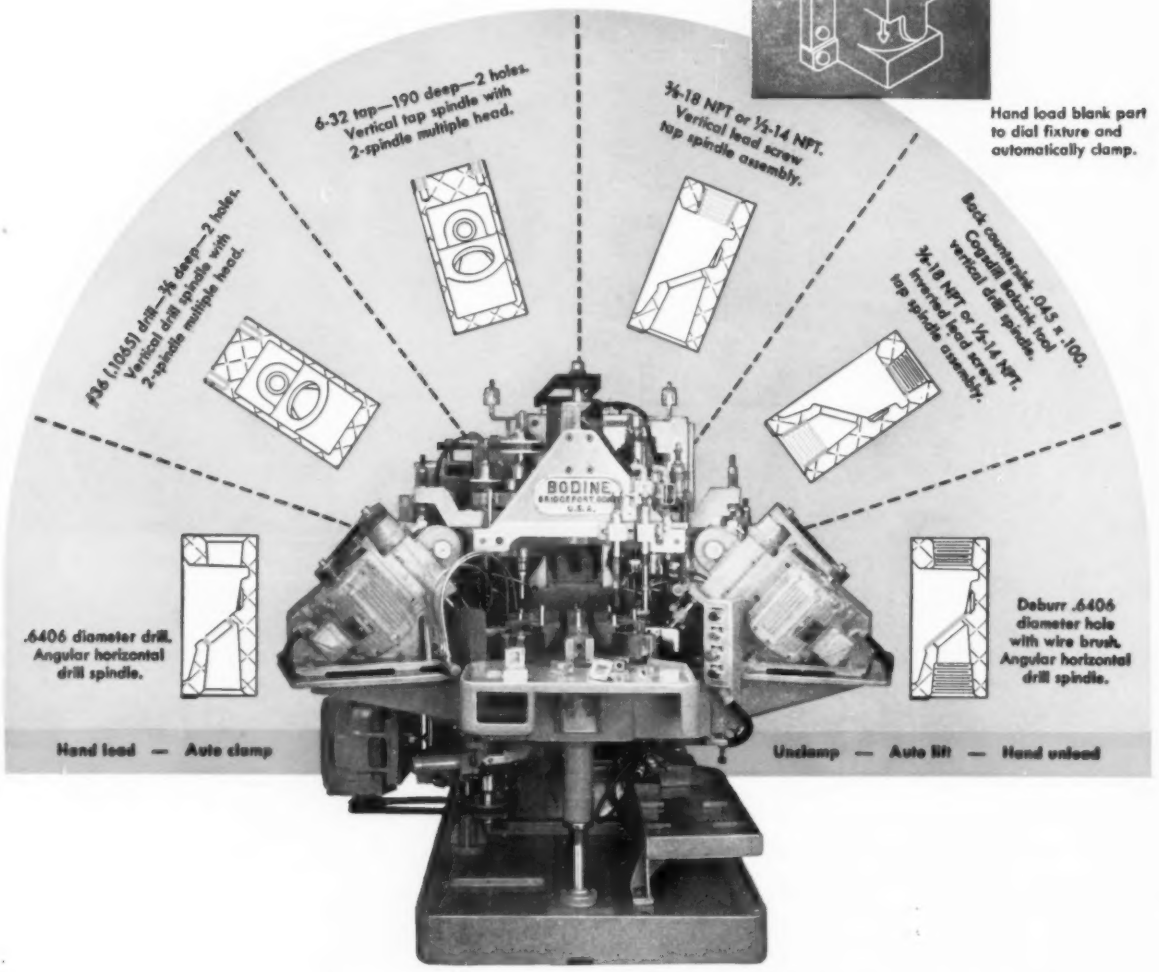
Bodine case history no. 46



Hand load blank part to dial fixture and automatically clamp.


6-32 tap—190 deep—2 holes. Vertical tap spindle with 2-spindle multiple head.
¾-18 NPT or ½-14 NPT. Vertical lead screw tap spindle assembly.
#36 (.1065) drill—⅞ deep—2 holes. Vertical drill spindle with 2-spindle multiple head.
Back counterdrill .045 x .100. Cogsdill Balzdrill tool vertical drill spindle.
¾-18 NPT or ½-14 NPT. Inverted lead screw tap spindle assembly.
.6406 diameter drill. Angular horizontal drill spindle.
Deburr .6406 diameter hole with wire brush. Angular horizontal drill spindle.
Hand load — Auto clamp
Unclamp — Auto lift — Hand unload
BODINE

Good way to hold a winning hand

in competitive manufacturing.

This major manufacturer of automatic control equipment has used cost-reducing Bodine Basic Machines and tooling methods for many years.

The interesting new Bodine unit shown above went in to replace another machine . . . to include MORE OPERATIONS, performed at a FASTER RATE.

The new machine features recently-developed Bodine reversing motor-driven lead screw spindles . . . one vertical and one inverted. The valuable versatility of Bodine tooling with combinations of vertical, angular and inverted spindles is clearly demonstrated.

This is also an example of how advanced Bodine tooling is constantly stepping ahead of production demands, even among present Bodine users. In all cases, such tooling is readily adapted to present Bodine Basic units, an important cost-advantage users of our equipment enjoy.

If you have a part you would like to produce better at lower cost, send us a sample and prints for analysis. No cost or obligation. Write Dept. TE-9.

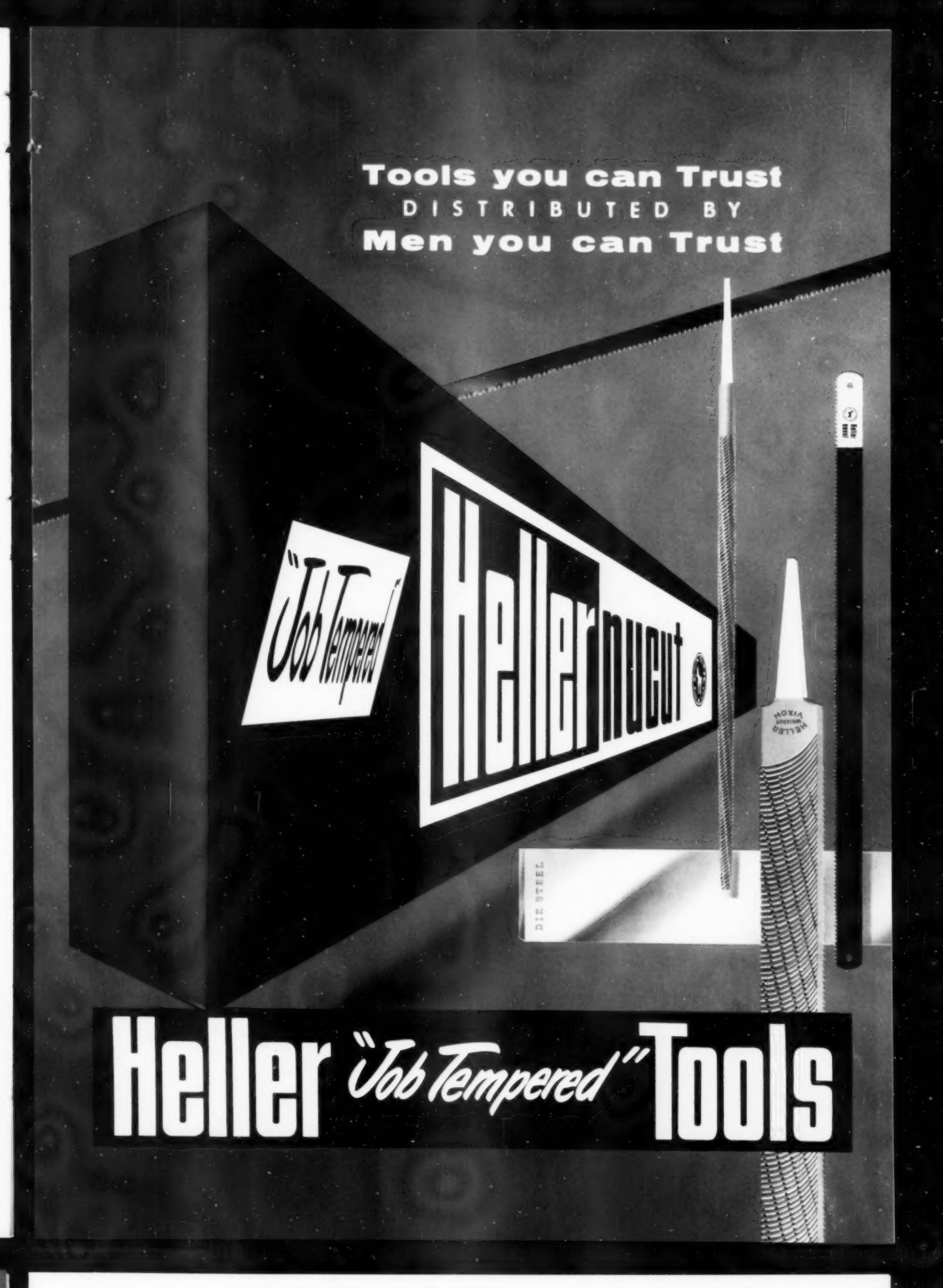
MATERIAL and PART: Zinc die-cast valve body.

PRODUCTION: 15 complete pieces per min.; 6000 operations per 50-min.hr.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

1BD59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TRUSTED SHORT-CUTS
TO LOWER COSTS

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FLAT GROUND
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Flat Ground Steel

Avoid costly machining-to-size and finishing operations with ready-to-scribe Heller Flat Ground Steel. Smooth finished to 25-35 micro inches and free from scale, decarbonization and surface defects, they are stocked in a wide range of over 1500 accurately dimensioned flats and squares.

HELLER FLAT GROUND DIE STEEL* is your best source of wear-resistant DIES, PUNCHES, PATTERNS AND PARTS. Available in *oil hardening* and *air hardening* types, it is spheroidize annealed for easy machining and uniform hardening. So, it cuts unit costs to profitable levels.

HELLER FLAT GROUND LOW CARBON STEEL meets demand for parts that require no heat treating or just case hardening. Made of fine-grained, silicon killed, forging quality steel, it is easy to machine and weld.

YOU CAN TRUST YOUR HELLER DISTRIBUTOR to save you money. Use his inventory. It is conveniently at hand, saves your time, frees your capital.

TOOLS YOU CAN TRUST
from
MEN YOU CAN TRUST
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SERVICE + STOCKS = SAVINGS

*Analyses Recommended by Leading Consulting Metallurgists

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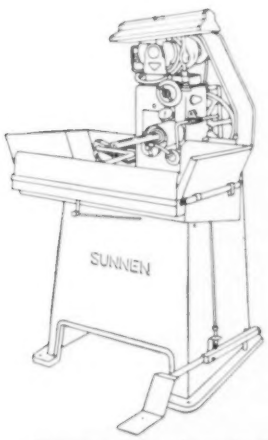
HELLER TOOL CO. SINCE 1894

America's Oldest File Manufacturer
NEWCOMERSTOWN, OHIO
Subsidiary of Simonds Saw and Steel Co.

Branches and Warehouses: Newark • Detroit • Chicago • Shreveport • Los Angeles • Portland, Ore.

HOW WOULD YOU PROCESS THIS TANDEM BORE JOB?



Diameter range of standard honing tools: ⅛" to 2⅝".

The piece requires a .0002" hole tolerance plus perfect alignment, roundness and straightness of both holes.

The best process for this tough job was Sunnen Honing. The Sunnen Honing tool hones both holes simultaneously . . . the workpiece is self-aligning on the tool. The *one* honing operation guarantees alignment, identical size and controlled surface finish in both holes.

Sunnen Honing eliminates the problems you have in machining tandem bores by other methods: clamping distortion; jump and chatter of long quills or boring bars; turntable alignment error; inconsistent finish produced by dull tools.

Sunnen Honing easily holds tolerances to .0001" . . . requires no fixtures and assures low cost per part. Average honing machine installation with tooling is around $1,000.

send for five informative

honing booklets

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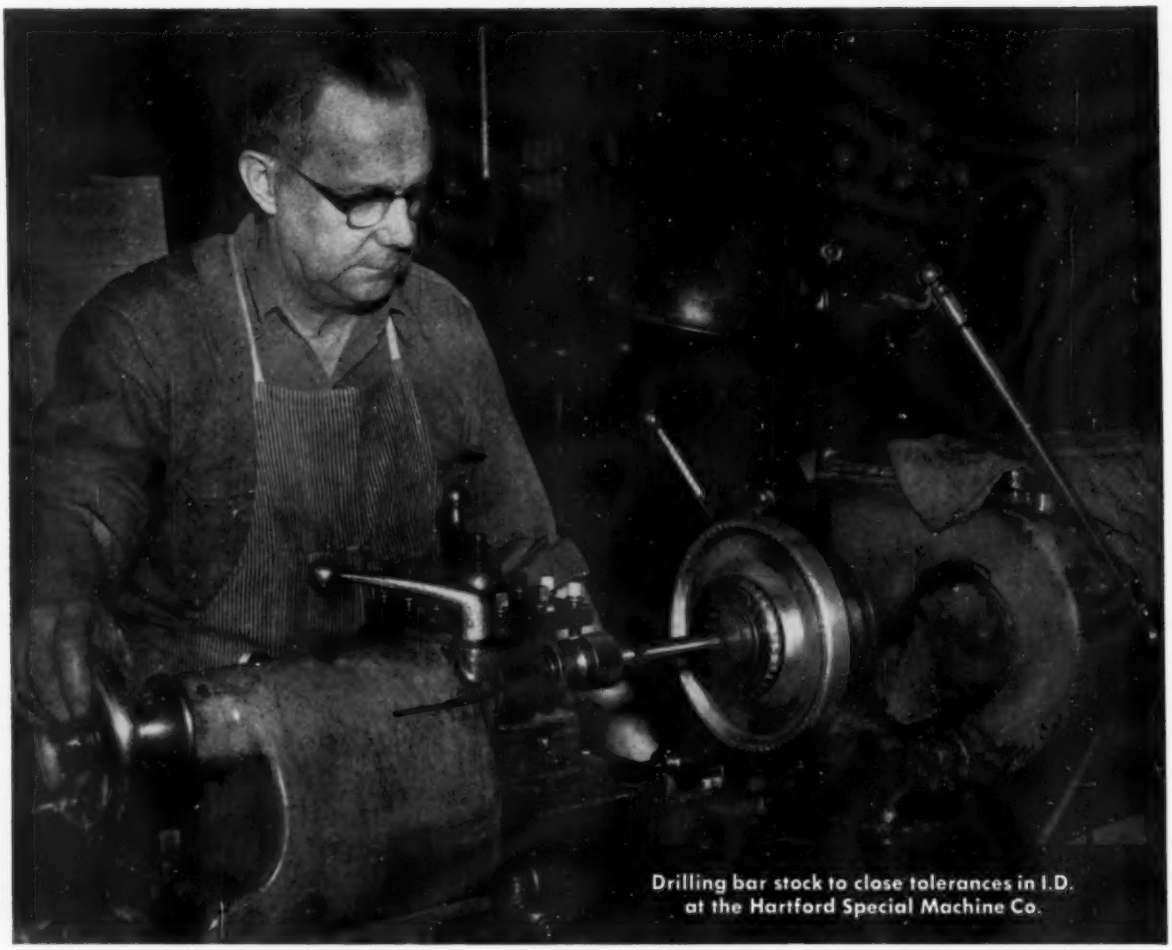
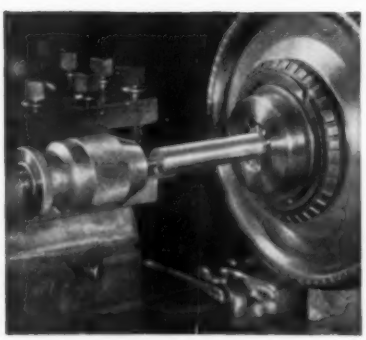


Drilling bar stock to close tolerances in I.D. at the Hartford Special Machine Co.

"The Jacobs Rubber-Flex Collet is the best collet I have ever used"



Albrecht Keyless Chuck and Jacobs Rubber-Flex Collet Lathe Chuck team up on center drilling job.

Mr. Shaler Rundberg drills steel bar on LeBlond Dual Drive 12" Lathe equipped with a Jacobs Model 91 Rubber-Flex Collet Chuck at head stock, and an Albrecht Model 130 J6 Keyless Drill Chuck at the tail stock. He often works with highly polished or finely ground parts. He says:

"The Jacobs hand wheel type lathe chuck lets me chuck polished or ground parts for additional operations without marring. The Rubber-Flex Collet is the best collet I've ever used."

You hold your work with the tightest, most accurate grip ever devised when you hold with the Jacobs Rubber-Flex Collet. Ask your industrial supply distributor for Bulletin 57-CC on the Model 96 Key Type Collet Chuck shown here and for Bulletin 57-LC on the Model 91 Hand Wheel Collet Chuck.

Jacobs and your industrial supply distributor are ready to deliver the chucks you need and the service you deserve. First in chucks . . . first in service.

Jacobs CHUCKS

The Jacobs Manufacturing Company, West Hartford, Connecticut

Precision TODAY to Gage TOMORROW'S Horizons

Current missile, atomic energy, and other similar projects are demanding gaging instruments capable of measuring with a precision thought impossible only yesterday . . . and of performing inspection jobs of extreme complexity. If *you* are engaged in missile or atomic development projects — or are planning to participate — you can count on Pratt & Whitney to design, develop and produce the special instruments you need.

We offer you a full staff of engineers and technicians, who have AEC and military clearance and work in classified areas. We also offer our proved ability as precision gage makers. We can develop gages to check components of any size or shape, and we can create gages fully integrated with business machines or other recording and analyzing devices. We are specialists in checking polar coordinates of contoured parts and in gaging miniature bearings and similar hard-to-inspect components.

Write, phone or call, and discuss your requirements with us. We're ready to start work now on gaging instruments for your projects. Pratt & Whitney Company, Inc., 16 Charter Oak Blvd., West Hartford, Conn.

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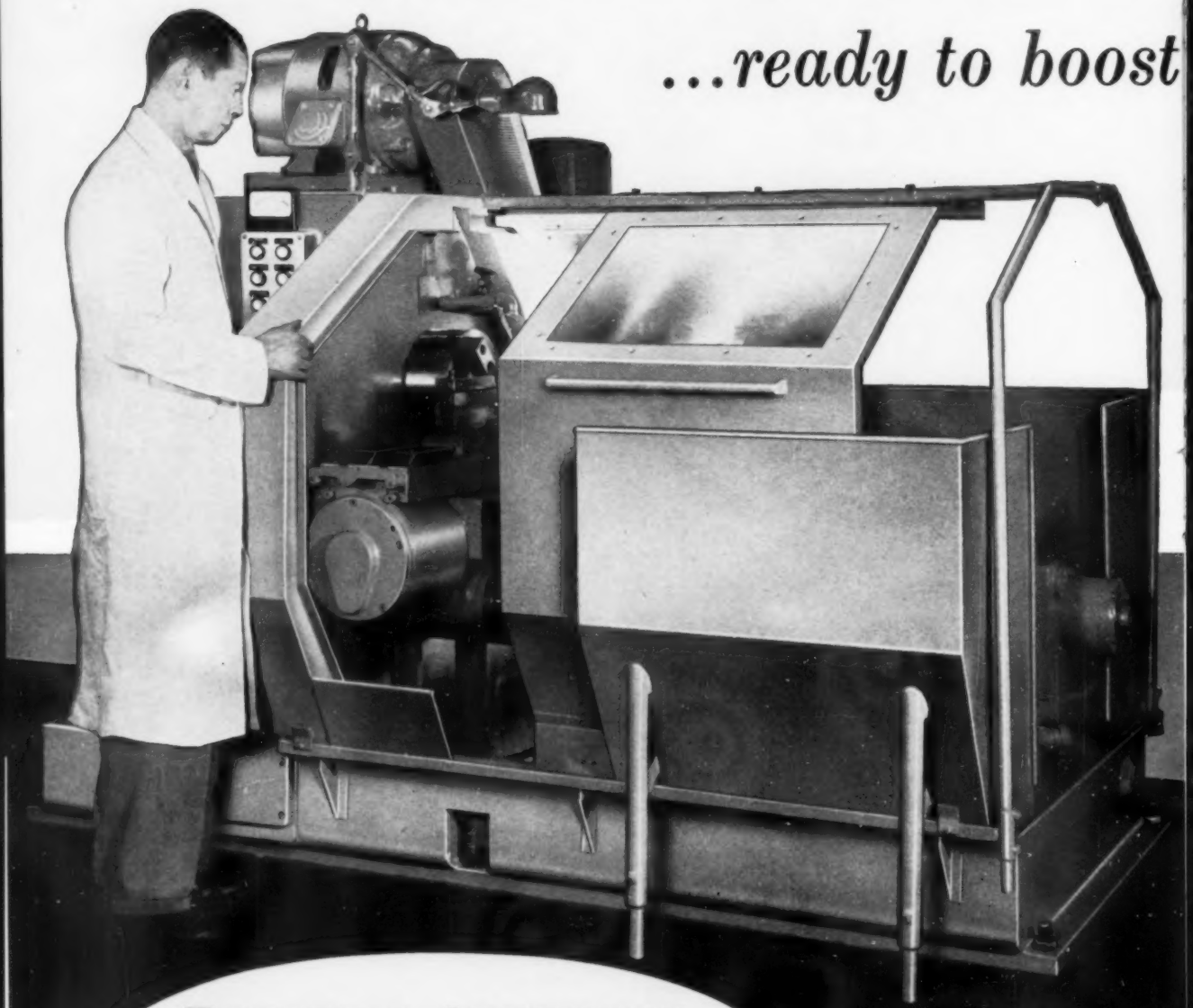
MACHINE TOOLS • GAGES • CUTTING TOOLS

ALL-NEW Automatic

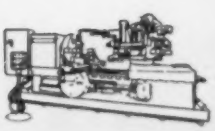
...ready to boost



POTTER & JOHNSTON

3E-15

AUTOMATIC
TURRET LATHES



P&J **POTTER**

Turret Lathe

YOUR production!

To help you produce parts faster and at lower cost, the Potter & Johnston 3E-15 Automatic Turret Lathe offers every advanced feature you've been looking for. It's completely new in design and construction. This machine gives you the power and extra rigidity you need to hog out tough alloys faster . . . plus the precision you want to hold closer tolerances and produce smooth finishes. Set-up is fast and easy, saving valuable time and insuring lowest per-part costs on both short and long runs. Real tooling versatility will help you machine the most complicated cuts with new speed and efficiency. The 10-inch chuck capacity combined with wide speed and feed ranges will let you handle a very broad variety of work types and sizes.

HERE'S EVERYTHING YOU NEED TO HANDLE YOUR JOBS FASTER, BETTER, MORE PROFITABLY —

FASTER METAL REMOVAL

- **INCREASED POWER . . .** with all-new 15 hp headstock for fast accurate removal of the toughest alloys.
- **GREATER RIGIDITY THROUGHOUT . . .** with new, heavy steel weldment base and hardened-and-ground tool steel ways.
- **TURRET COOLANT SYSTEM . . .** in addition to overhead system. Lets you pump coolant through turret tools for maximum efficiency in drilling, boring and other internal machining operations.

FASTER SET-UP

- **NEW CROSS SLIDE CONTROL . . .** with selector switches now provides faster, easier set-up for delayed or on-time movement. Cross slides can be operated together or independently with any turret face and can be adjusted longitudinally, independent of each other.
- **NEW INDEPENDENT MOTOR DRIVE FOR TURRET INDEXING . . .** permits indexing during set-up without forward travel of the turret.
- **EXTRA-LARGE CONTROL DRUM . . .** located for easy access, insures fast programming of all machine functions including automatic speed and feed changes, rapid traverse, etc.
- **6-FACE TURRET . . .** allows opportunities for greater tooling flexibility.

REDUCED MAINTENANCE

- **ELECTRIC CLUTCHES THROUGHOUT . . .** are self-compensating for wear, require no adjustment.
- **CENTRALIZED AUTOMATIC LUBRICATION . . .** for turret slide, cross slide and base, reduces wear and insures smooth operation of all moving parts.

SEND NOW FOR THE FACTS . . . *mail this coupon today for your free copy of Bulletin No. 172. Contains complete data and specifications on the new Potter & Johnston 3E-15 Automatic. If you prefer, ask a P&J Representative to call and discuss its advantages with you. There is no obligation, of course.*

POTTER & JOHNSTON COMPANY
Newport Avenue, Pawtucket, Rhode Island
Without obligation —

☐ Please send my copy of Bulletin No. 172, with all the facts on the new P&J 3E-15 Automatic Turret Lathe.

☐ Please have a P&J Representative call and show how a P&J 3E-15 can help me cut costs.

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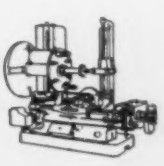
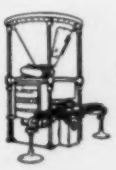
& JOHNSTON

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INC.

PRECISION PRODUCTION TOOLING SINCE 1898

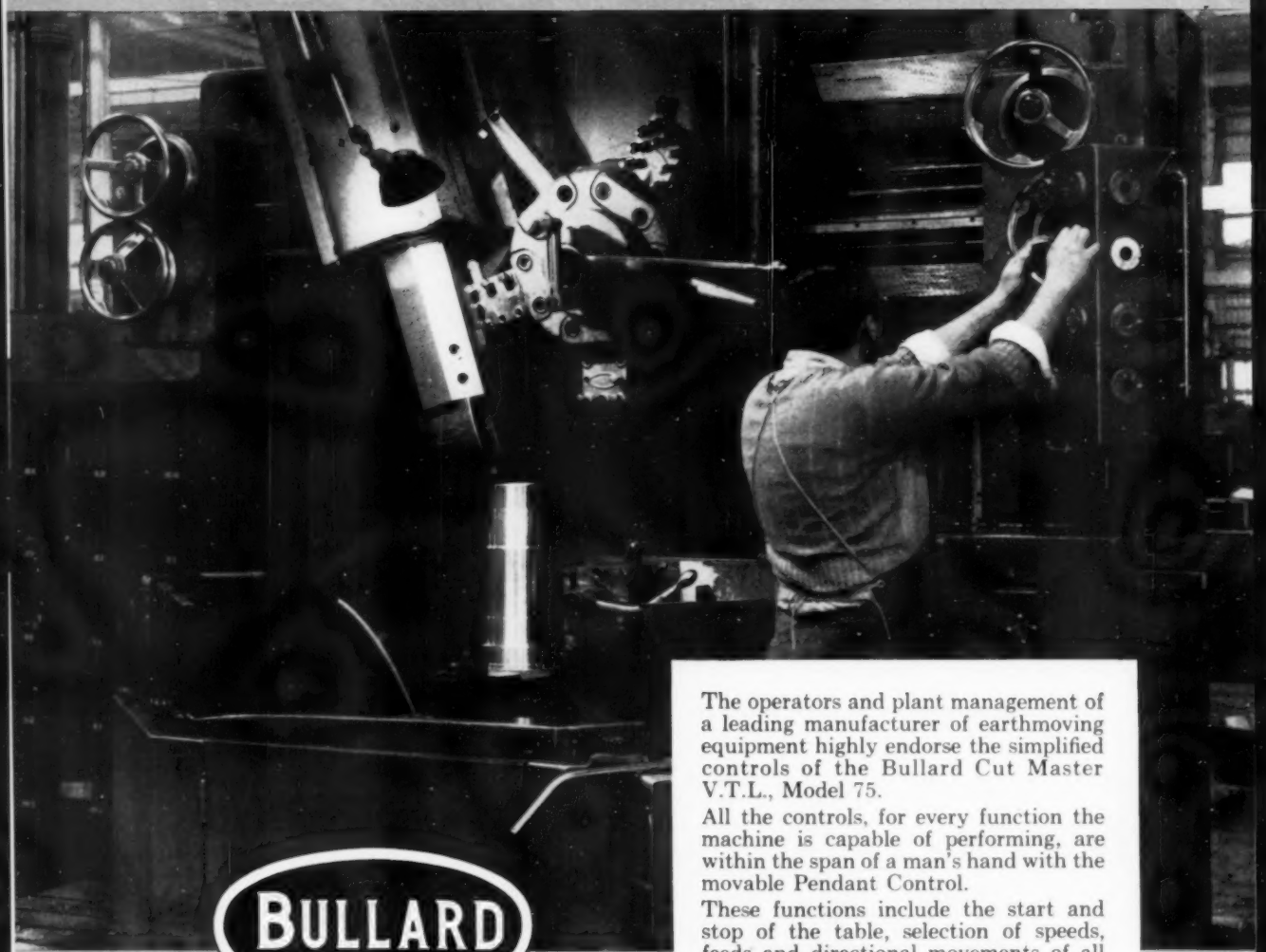


GEAR CUTTERS



PACKAGING MACHINES

Simplified Controls win enthusiastic approval



The operators and plant management of a leading manufacturer of earthmoving equipment highly endorse the simplified controls of the Bullard Cut Master V.T.L., Model 75.

All the controls, for every function the machine is capable of performing, are within the span of a man's hand with the movable Pendant Control.

These functions include the start and stop of the table, selection of speeds, feeds and directional movements of all heads in feed or traverse.

This feature, a Bullard exclusive, improves the efficiency of the operator and increases production.

To cut costs when cutting metal

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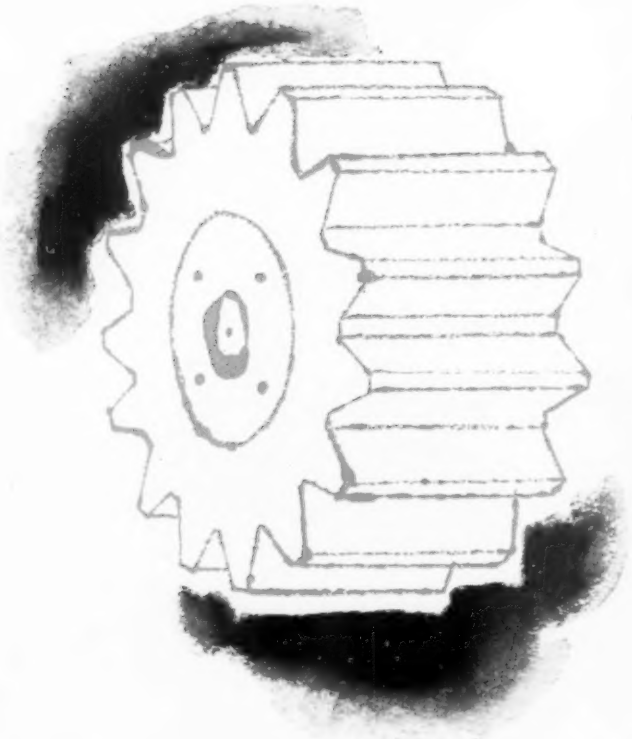

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The more gears your equipment can hob before tool change, the lower your cost of operation. Sinclair Ordnance Cutting Oils have earned the reputation for increasing tool life because of their high heat dissipation characteristic. Furthermore, a special E. P. agent assures the highest quality finish . . . more money saved through fewer rejects. Switch to Ordnance, now. Next time management asks how you've cut costs, tell them you've changed to Sinclair—and show them the results.

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Measure in Millionths

WITH THE New

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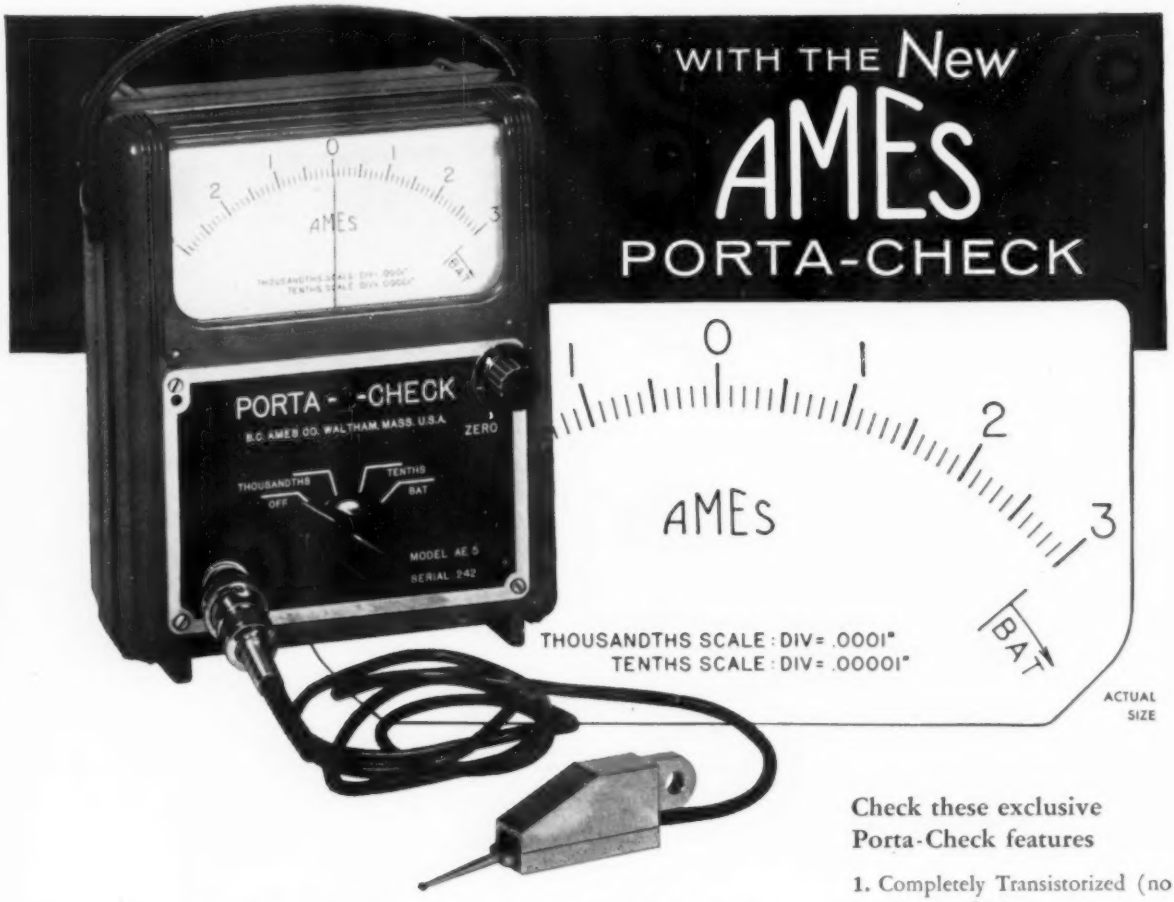

Now you can see ten millionths of an inch . . . Easily estimate five millionths . . . with Ames Portable Transistorized Comparator.

An amazingly sensitive comparator, Ames Porta-Check now makes it possible to get accurate measurements—*in millionths of an inch*—anywhere in the plant. Use it on the production line; at quality control check points; in the tool room – wherever you need it!

Porta-Check converts minute dimensional variations to voltage changes and amplifies them so they can be read easily and accurately. The meter dial—shown in actual size—can be used as either a "tenths" scale or a "thousandths" scale by simply setting the front panel rotary switch.

As a "tenths" scale it is graduated directly to *ten millionths*. With the generous spacing between graduations it is easy to estimate *five millionths*. Total range on this scale is .0006".

As a "thousandths" scale it is graduated directly to .0001", making it simple to estimate "half tenths". Total range on this scale is .006".

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4. Accurate, Sensitive, Rugged
5. Simultaneous zero setting for both scales
6. Simultaneous magnification setting for both scales
7. Two scales: "Tenth" scale graduated to *ten millionths*

   "Thousandths" scale graduated to .0001"

The new Ames Porta-Check is truly the most accurate portable comparator available today – and it's low in cost! See your local Ames representative or write directly to the factory for complete details.

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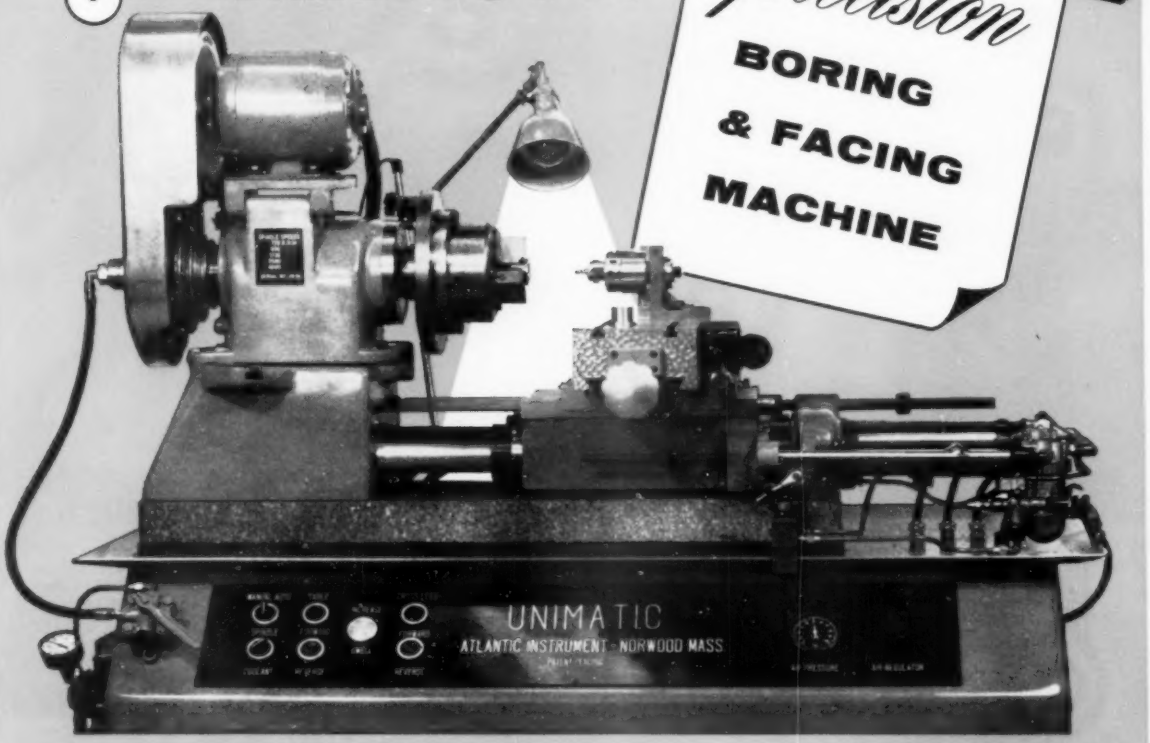

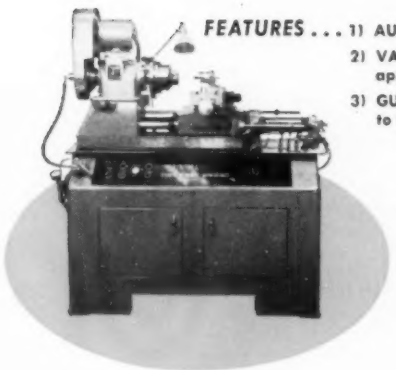

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The UNIMATIC *comprises an extremely accurate machine element, mounted on a granite base scraped to a tolerance of .00005", with other features (fully explained in our catalog) neutralizing the effects of temperature variations.*

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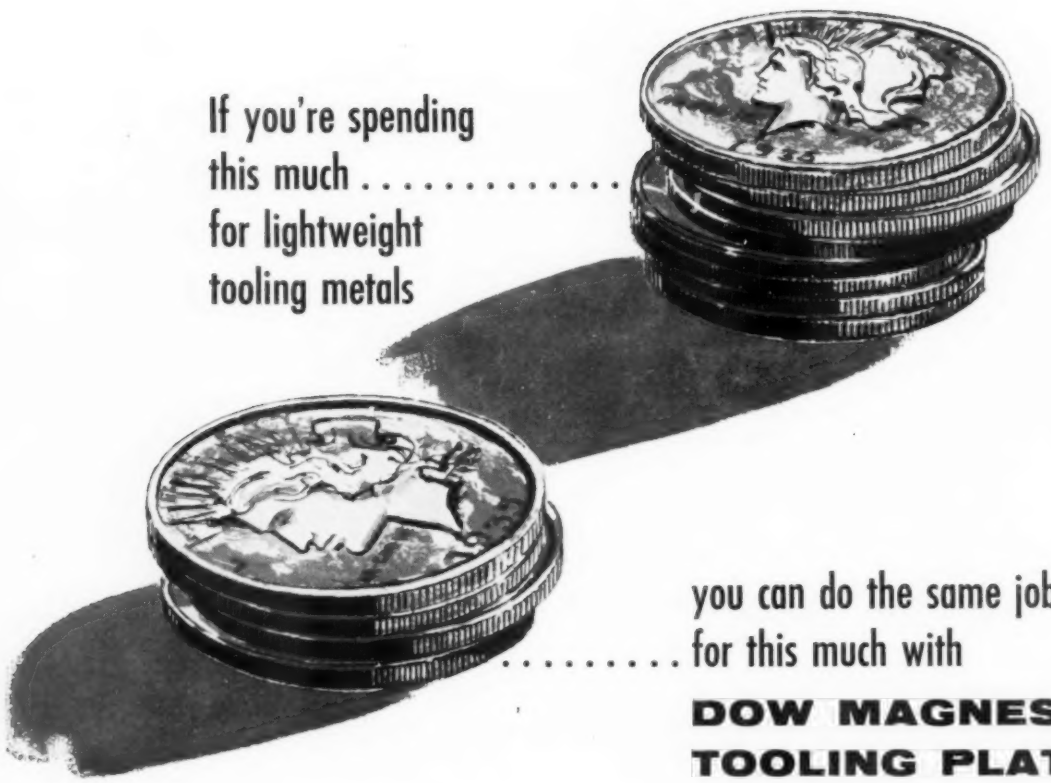

It's true! Dow magnesium tooling plate costs up to 35% less than other lightweight tooling metals. The fundamental characteristics of magnesium permit rolling and oven thermal flattening to a degree of flatness and surface smoothness satisfactory for virtually all tooling uses. This flatness is not obtainable in other lightweight tooling materials without costly machining of the surface.

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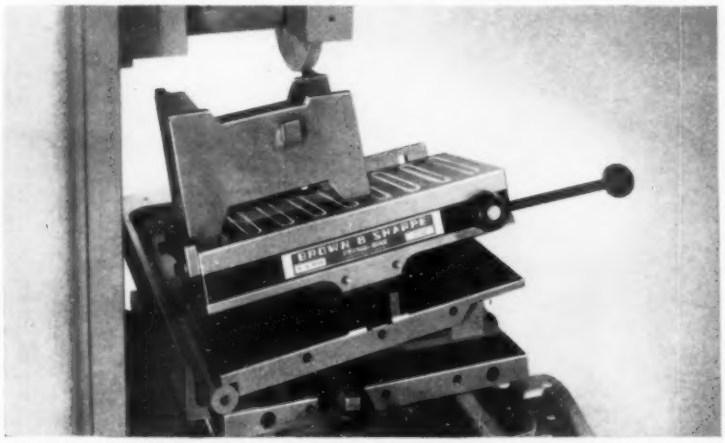
Precision Tool News

NO. 7 REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER

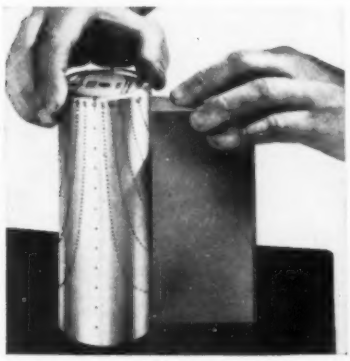


8 New B&S Sine Tools Speed Precise Angular Settings for Work-Holding and Inspection

Brown & Sharpe's new Perma-Sines establish angles quickly and precisely . . . hold work magnetically, without clamping. Their permanent-magnet surfaces switch ON or OFF at the turn of a lever, yet require no electrical connections. "Firm" hinges eliminate the need for clamping plates and possible distortion during attendant tightening. Direct contact of the rolls with gage blocks prevents inaccuracies caused by intervening members (with the spacing necessary between such members and rolls). All parts except magnetic surfaces fully hardened; top plate flat to .0002" all over; roll centers held to .000030" per inch.

Brown & Sharpe Inspection Sine Plates have tapped holes for holding devices in sides, ends and tops . . . offer maximum accuracy for inspection work. Flat *over-all* to .0002", they are made of normalized and seasoned steel, *fully hardened throughout.*

B&S Perma-Sines and Inspection Sine Plates are both available in simple and compound types; 5" and 10" sizes.



New B&S Square Shows Amount of Out-of-Squareness at a Glance

One end of the B&S Direct Reading Cylindrical Square is precisely ground and lapped "out of square" to a predetermined degree. When the square is rotated, its angle with the base surface will at some point match the angle of the work piece, and shut out light against the work. Out-of-squareness is then read directly in .0002" by following the dotted curve nearest the top of the work edge to the top of the cylinder. The other end is precisely square with the cylinder.

New B&S Hite-Cheks for Use with Test Indicators Provide Higher Accuracy at Lower Cost

To transfer the very accurate dimensions set up by B&S Hite-Sets, Hite-Icators, etc., devices are required that will support any dial test indicator . . . in any position . . . *without chatter or other vibration.* Brown & Sharpe's new Hite-Cheks (right) do this job superbly. Hite-Cheks repeat all "low" and "high" measurements precisely, even with high-amplification indicators; are lower in price than all graduated devices.

Unusual, box-type uprights of aluminum provide rigidity and stability without excess weight; sturdy bases, with hardened and lapped graphitic steel wear pads *do not chatter.* Two-piece sliding heads provide quick rough settings, positive fine adjustments . . . can be securely clamped. 24", 36" and 48" sizes.

These Tools Available Now Through Your B&S Distributor

Brown & Sharpe's newest accuracy-boosting, cost-cutting tools are available through your nearby B&S distributor . . . at factory prices. Brown & Sharpe Mfg. Co., Providence 1, R.I.

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Booth 824, Western Tool Show

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form INTERNAL THREADS without cutting

X-PRESS TAPPING METHOD
Stronger threads. Grain fibers unbroken. Metal compacted and hardened.
Burnished thread, no cutting.
NO CHIPS

BESLY X-PRESS® TAPS

CONVENTIONAL TAPPING METHOD
Produces chips that may clog flutes, cause loading. Result—excessive breakage.
Grain lines of metal are cut.
CHIPS

New Revolutionary Tapping Principle Cold Forms Internal Threads In . . .

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- BRASS
- ZINC
- LEADED STEELS
- ALUMINUM
- LEAD
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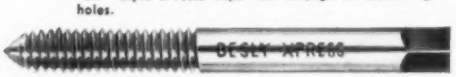
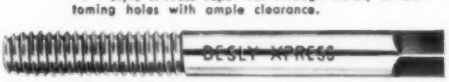
BESLY X-Press Tapping is a cold forming or swaging process for producing internal threads in ductile metals. The desired thread is formed under pressure. The grain fibers follow the contour of the thread, as in good forgings. They are not cut away as in conventional tapping methods. Complete application details are available — see your Besly distributor, or send coupon. *Where this new tool can be successfully applied the results are* phenomenal! *It would pay you to try them yourself — NOW!*

"SR" Style X-Press Taps—for through or bottoming holes.



"P" Style X-Press Taps—for through holes, or bottoming holes with ample clearance.



"B" Style X-Press Taps—for bottoming holes only.

"PC" Style X-Press Taps—same work as "P" Style series, except the root diameter controlled at 75% of thread.

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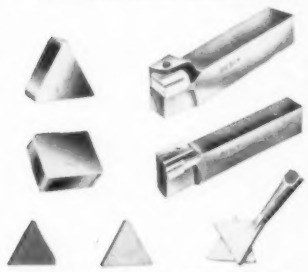

Commercial Finish | Besly Finish | Lapped, perfectly flat surfaces easily wring together.

Special Besly lapping process gives more tool life per cutting edge with less chipping and breaking. Wide range of sizes, positive and negative rakes. Holders in styles and shank sizes to fit the job.

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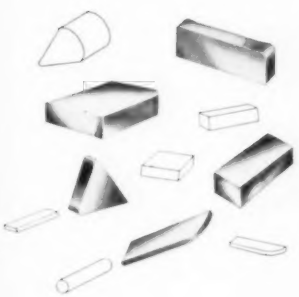

In sizes, grades and styles for every cutting need. Standards include: reamer blanks, lathe center blanks, rectangular strips, solid cylinders, pulley grooving blanks and others. "Specials" made to order.

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Standard tools supplied in a variety of grades, sizes and styles for turning, facing, boring, chamfering, planing, milling, end cutting, threading and grooving in cast iron, non-ferrous, steel and steel alloy metals. Modifications and "specials" made to fit specific jobs.

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...means that BESLY carefully makes every Carbide Tool to the highest standards of **accuracy** and **quality**

Only the best materials and methods are used in their development — advantages which give you longer life, less downtime, fewer rejects and higher production rates at lower cost.

A complete range of standard styles and sizes is always available for *overnight delivery* through your Besly distributor. Ask him for Catalog 857 and for Besly's super-service on "specials."

Besly has a few select markets open for distributors who can handle carbides. *Write for details.*

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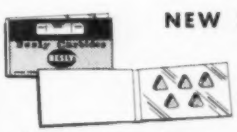

Skin-Pak for Inserts and Blanks

Lapped toss-away inserts, carbide blanks, in standard package quantities, are conveniently arranged on 3" x 5" file card size fold-over cardboard pack secured with transparent polyester film for complete protection. Besly's new package prevents chipping of cutting edges and insures perfect condition, ready for instant use.

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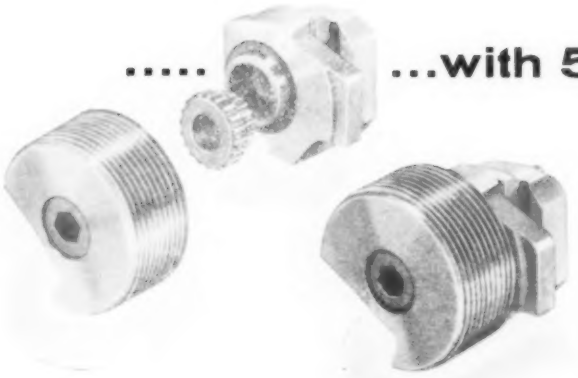

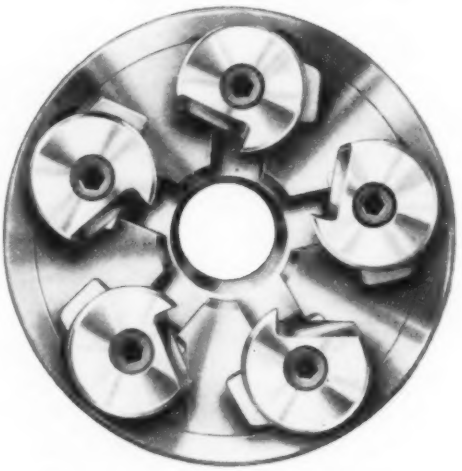

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Now with 5 chaser heads available in a complete range of sizes . . . *add up these conclusive facts—and prove it to yourself!*

Write for complete information

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- 5 Chasers permit threading of parts with flats, slots, keyways, etc.

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Opportunity Knocks!

In a recent NBC radio program titled "America on the Go," Alex Dreier stated, "The nation looks to its tool engineers for an even higher rate of productivity and an even higher standard of living in the future. The prospects of an increased population and the demands for a shorter work-week make it imperative that productivity leap again, and it is the tool engineer who bears the responsibility for making it happen."

ASTE is ready to help us bear this responsibility through its expanded educational programs.

As schools across the nation resume operations this month, we tool engineers should take note and remember that, for us, school never lets out. We must forever be striving to keep abreast of the rapid technological changes constantly taking place.

Our Western Tool Show, opening September 29 at Los Angeles, is an important educational opportunity. Technical sessions and symposia are planned around the theme of "Tooling for the Space Age." During the week, more than fifty papers will be presented, most of which will be available to the membership through the published *Collected Papers*.

Other plans in the Society's educational program include seminars on creative manufacturing and lecture series on advanced tool engineering practice for presentation in co-operation with interested chapters.

These are opportunities to help ourselves as individuals, and to help our nation's welfare and security through the companies for which we work. Let's make full use of them and be thankful we have a virile Society to provide them.

G. A. Goodwin

PRESIDENT
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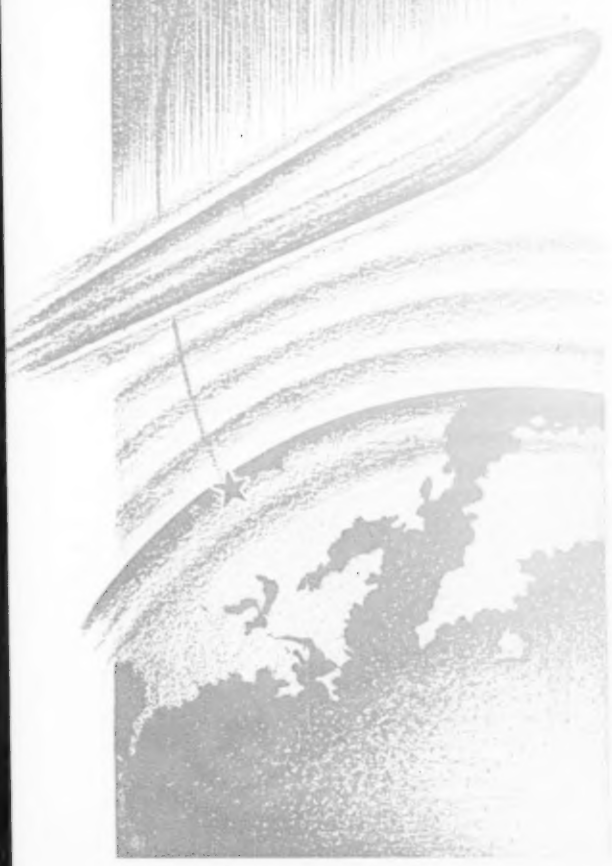
TOOL ENGINEERING for the space age

By T. W. Black
Senior Associate Editor



As modern technology moves inexorably toward the Space Age, tool engineers in the aircraft and missile industry are forced to solve tomorrow's manufacturing problems today. This article tells what these problems are and how they are solved by creative engineering.

FROM A MANUFACTURING POINT OF VIEW, products for the Space Age are quite different from products for the Automotive Age. It is entirely possible to mass produce aircraft and missiles on a Detroit assembly line basis; Ford Motor Co. did just that with bombers during World War II. Today, aircraft are produced in dozen lots. Due to low volumes and constant design improvements, investment in mass production tooling is not feasible. The problem is, then, to develop efficient tooling at minimum costs. This problem is complicated by the introduction of new high-temperature materials, some of them generally considered unmachinable or unformable until a few months ago. Close tolerances add another complication, as do increasingly short lead times. Reliability of aircraft and missile structures as well as associated electronic control and guidance systems, *Fig.* 1, must be well-nigh perfect, placing a heavy responsibility on manufacturing. In this day of nuclear warheads, failure of any one

Fig. 1. Operator assembles component of airborne fire control system. All components are in individual containers within easy reach of operator. Linedex chart in front of operator shows operation.

of the thousands of components in an air-to-air rocket weapon, for instance, may result in the destruction of an entire city.

These are Space-Age problems. For all practical purposes, an aircraft or missile designed to travel at three or four times the speed of sound, at altitudes up to twenty miles, is a space ship. Protection of personnel, protection against overheating due to atmospheric friction, the need for automatic guidance systems—all of these factors must be faced by the engineers who design or build today's aircraft weapon systems. These factors differ in degree, but not in kind, from the factors that will be faced when mankind at long last takes its next great forward step—travel to another planet.

Space-Age tool engineering is new; it deals with new materials, new processes, new fabrication techniques. Yet the Space-Age tool engineer is faced with the age-old problems of holding manufacturing costs down, keeping quality high and meeting production deadlines. These problems are being solved with notable success in dozens of plants. To find out how, tool engineers in a number of representative plants were consulted. Their answers to specific questions are illustrative of some of the most important trends in tool engineering for the Space Age.

Assembly Techniques: Tool engineers at North American Aviation, Inc., point to dozens of instances where the transition from aluminum and magnesium—typical aircraft structural materials—to stainless steel, titanium and similar high-temperature materials has resulted in changed techniques. Traditionally, aluminum and magnesium aircraft have been assembled by riveting and spotwelding. With new materials and more stringent design requirements it has been necessary to adopt fusion welding for assembly, usually by shielded-arc methods.

With fusion welding, it is virtually impossible to "take up" tolerances on assembly, so large mating assemblies must be accurate to within 0.004 inch, contrasted to the 0.030-inch tolerances for "normal" aircraft assembly work. Further, skin thickness variations in sheet metal parts cannot be tolerated, since they cause weight and strength variations in finished parts. Most sheet metal comes from the mill with ± 10 percent thickness variations. Consequently, it is often necessary to grind both sides of incoming sheet metal before it can be formed.

Hot Sizing: Tolerances for formed detail parts are held to 0.001 inch. This means that forming tools and dies must be extremely accurate, with consequent increases in construction time and costs. Forming of aluminum and magnesium parts to close tolerances presents no problems when tools are accurate. With the new high-strength materials, however, buckling, warping and splitting of parts during and after forming can lead to rejection rates as high as 100 percent.

North American has overcome these limitations

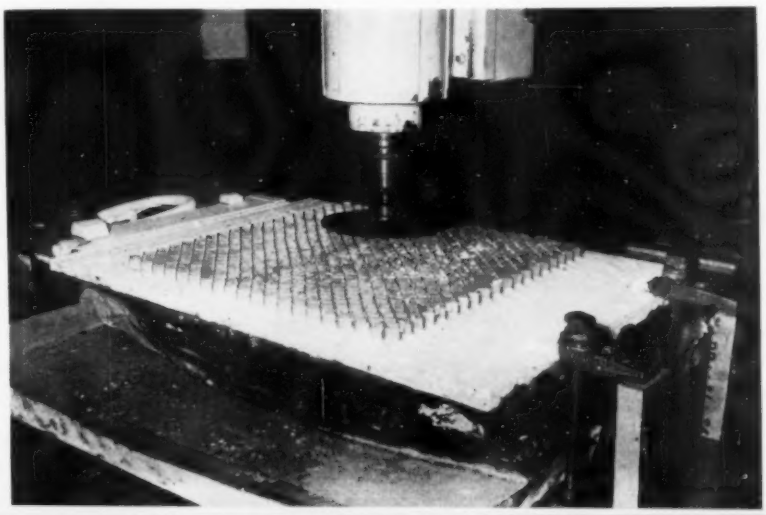


Fig. 2. Ice chuck holds fragile honeycomb materials securely for machining, yet eliminates any possibility of distortion. Ice chucks are also used to hold sheet materials.

by developing a technique known as "hot sizing." Parts are preformed on conventional rubber dies and are then placed between heated die segments (1200 F for titanium parts). During forming, the web and flanges of the part are constricted; hence they cannot buckle or warp. Both ends of the die are open to allow endwise expansion of the part during forming. Using this forming method, it is possible to make 90-degree bends in titanium while allowing extremely small bend radii. In some cases, bend radii are equivalent to the thickness of the metal. Such radii were previously "impossible."

Forming tools are usually made to the cold dimensions of the part. In most cases, expansion of the heated tool is compensated for by expansion of the workpiece. If a workpiece does not shrink to correct size after cooling, die modifications are, of course, required. With complex shapes, trial-and-error tests may be the only answer.

An added difficulty is encountered when forming precipitation-hardening materials, stainless steels for example. These materials are subject to 0.004 inch-per-inch growth during transformation, so all forming tools are made slightly undersize. North American tool engineers make drawings for these tools full size and then reduce them in size photographically to compensate for workpiece growth.

Machining Hard Materials: Machining of high-strength or hardened materials presents a major problem because of the slow speed of most conventional machining processes. In the opinion of North American engineers, grinding offers the best means for machining hard materials at present. Electrolytic grinding methods are promising, but their application is limited because of the small capacities of the electrolytic machines available. Applications will be multiplied with the delivery of a 2000-ampere machine in the near future.

A significant advantage of this process is that there is no significant heating during machining; consequently, there is no heat-affected zone. Metallurgical properties of the workpiece remain uniform —an absolute must for some Space-Age components.

Some work has been done with ceramic (cemented oxide) cutting tools at North American, but results have been generally unsatisfactory because the majority of workpiece configurations involves interrupted cuts. The ceramic tools tested simply could not stand up under the cutting conditions involved. Improved ceramic cutting tools will be tested when they are made available. Results of high-speed cutting tests have so far been inconclusive.

Machining of thin, fragile or delicate materials seems far removed from machining "superhard" materials, yet both types of work are encountered in aircraft and missile manufacture. Honeycomb materials are particularly difficult to machine because holding fixtures that apply pressure would permanently damage the workpiece. A simple trick developed by North American engineers is the use of "ice chucks," *Fig.* 2. Frost and ice formations on these refrigerated chucks hold delicate honeycomb structures securely in place during machining.

As often happens, a tooling development that solves one problem may solve another. Stainless steel and some other materials tend to work-harden during machining. It has been discovered that work-hardening is retarded when materials are chilled, so the ice chuck is now applied for machining of sheet materials. Difficulties caused by work-hardening are eliminated.

Development of new aircraft and missile designs, and the application of new materials, are accompanied by continuing manufacturing process development. An example is the use of belt grinding for finishing contoured part areas at North American. Once the feasibility of this finishing method had been established, it was necessary to develop a suitable belt-grinding machine. A prototype model was designed and built to serve as a guide in the design of a full-size machine.

The belt passes over an accurately contoured wood or plastic roller which is formed to the desired part contour. The method of contouring the rollers is ingenious, yet extremely simple. The belt is reversed so that the abrasive coating is in contact with the roller. A contoured part or template is then pressed against the back of the moving belt, contouring the roller in a manner similar to form-dressing a grinding wheel.

Numerical control of machine tools has definitely come into its own as a Space-Age technique. North American engineers have developed their own numerical control system—the Numill—(see THE TOOL ENGINEER, May, 1958, page 115) which has

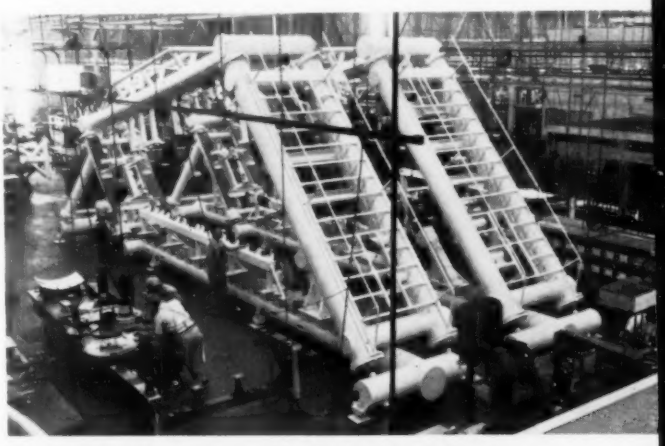


Fig. 3. Aircraft wing assembly fixture has ball-and-socket joints to allow quick teardown and subsequent rebuilding at a field location.

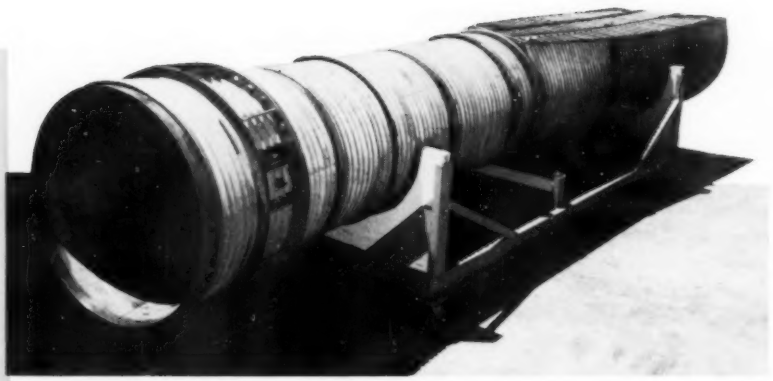
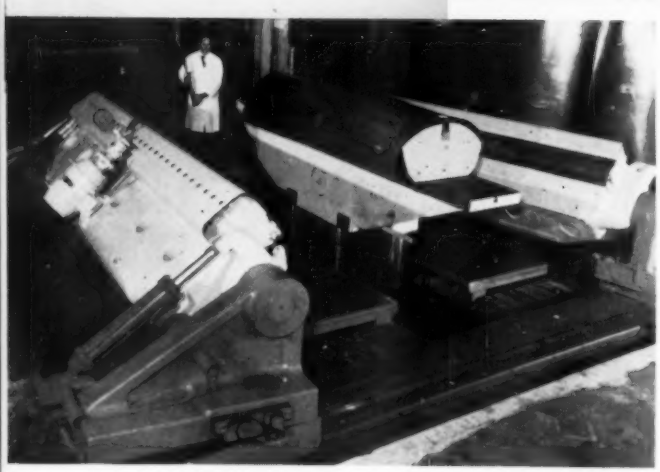


Fig. 4. Duct for ram jet engine was completely fabricated through use of plastics tools.

Fig. 5. (below) Sheet metal parts are resistance heated for forming on horizontal stretch press.



been utilized for making machining templates. Time savings with the numerically controlled machine are important, of course, but in template manufacture the improvement in accuracy is even more important. It has been estimated that the greatest accuracy that can be held with manual filing methods is ± 0.003 inch. Much closer accuracy is required for profile bars and cam bars used for milling advanced aircraft parts and this accuracy can be obtained only by eliminating manual methods.

Although present high-strength materials are difficult to machine, even greater difficulties are expected when machining aircraft materials of the future. Preliminary work is being done now at North American to overcome these difficulties before large-scale production is under way.

Looking to the future, for instance, beryllium appears to be an ideal Space-Age material. Its weight is comparable to that of magnesium and its "stiffness ratio" (all-important in advanced aircraft and rocket design) is four times that of steel. Unfortunately, this material is highly toxic and North American engineers are already contemplating the possibility of dressing machine operators in protective suits, complete with individual air supplies. In the Space Age, machine operators, as well as pilots, may have to wear space suits.

Machine Flexibility: Every effort is made to anticipate future developments when specifying machine tools and equipment. A machine that is adequate for today's material and part configuration may be rendered obsolete by an engineering change. Consequently, wherever possible, the building-block concept of machine design is preferred. An example is a rotary-index machine with interchangeable machining heads. However, building-block heads intended for machining aluminum may not be satisfactory for harder materials. Thus there is a trend toward specifying comparatively massive tools even though their capabilities may not be fully utilized on present operations.

Similarly, when designing equipment for the hot sizing process, provision is made for attaining temperatures of 1800 F, even though present materials form readily at 1300 F. Tool engineers have become accustomed to looking years ahead.

Brazing Problems: Present and future product designs call for a great deal of brazing, some of it done in controlled atmospheres because of the tendency of aircraft materials (titanium, for instance) to oxidize or corrode in air. At North American, brazing techniques include salt bath, electric blanket, furnace, heated platens (die quenching) and retort.

Brazing in "luminous wall" furnaces is particularly interesting because in this type of furnace most of the heat is directed on the part and there is no need to heat the walls of the furnace itself. In luminous wall furnaces (developed by A. F. Holden Co., Detroit), a mixture of air and combustible gases is introduced under pressure into an outer plenum chamber. The mixture passes through a porous inner wall and is then ignited. Because each pore acts as a tiny burner, there is no need for any

other burner mechanism. Further, as the gas-air mixture expands, it cools the porous wall continually, minimizing the wall breakdown and relining problems common with other types of furnaces. Once the desired heating of the braze material has taken place, the flow of combustible gases is cut off and a flow of cooling air is introduced.

Where corrosion at brazing temperatures is a problem, brazing in a sealed retort is a necessity. The retorts used for brazing honeycomb panels at North American are perhaps a foot thick and can accommodate honeycomb panels of large size. The panels are sandwiched between sheets of graphite to insure that all surfaces to be brazed are contacting each other. Air is evacuated and an inert gas is pumped into the retort. The retort is then heated to brazing temperature and subsequently cooled.

New Welding Methods: For some time, North American has been working with corrugated sandwich structures. In this type of structure, a corrugated sheet, rather than a honeycomb is used; thus the cells run parallel to the skins, rather than at right angles. Such structures can be readily seam welded; however, supporting the structure during welding is something of a problem. One solution being worked on at North American is to insert a long stainless steel "balloon" between the corrugations, expanding it with gas to give the required support to the structure during welding.

Excessive heating is a problem when welding extremely thin-skin materials. A possible solution, not yet in production use, is "pulse welding." This is similar to resistance welding, but current is applied in extremely short pulses through an electronic control. The molecules of the materials are agitated sufficiently to produce a bond, but there is no significant heating.

Field Repairs: Aircraft tool engineers are concerned with the problems involved in making field repairs on aircraft, as well as with initial assembly. New production assembly jigs at North American are designed with field repairs in mind. These jigs are fabricated with ball-and-socket joints so they can be quickly disassembled in the plant, shipped by rail or air to the point where they are needed, and put back together anywhere.

Recently a wing assembly jig over 40 feet long, Fig. 3, was taken apart in two hours, shipped to another location and then reassembled by four men during the course of an eight-hour shift. These jigs are equipped for rapid optical checking.

Plastics for Tooling: Plastics tooling is much in evidence at North American. In addition to savings in fabrication costs and reduced lead time, plastics make it possible to quickly tool some parts that would be virtually impossible to tool in any other way. An example is a duct for a ram jet engine, *Fig.* 4. The duct is assembled from individual corrugated sections and welded on a special fixture. Diameter of the duct is approximately four feet.

A master template, in plaster, served as the basis for developing all plastics tooling. The tools required were a steel die for making corrugations, a fixture for welding the components of the duct together, a stretch die and a sizing die. Working from the master plaster template, using intermediate plaster splashes where necessary, the plastics tools were quickly fabricated.

Flat sheets are first corrugated on the steel die. Duct components are then formed into a curved shape on the plastics stretch die and brought to final size and shape on a pair of conventional plastics forming dies. The welding fixture is also of plastics construction. Use of a series of plastics tools, all developed from the same template, has insured dimensional uniformity of all tools in the series. Obtaining this uniformity is often difficult when fabricating conventional metal tooling.

Machining Exotic Materials: Engineers at Northrop Aircraft encounter problems similar to those faced by engineers at North American, although their solutions to these problems are not always the same. Northrop manufacturing research engineers are currently surveying possible methods of machining exotic materials such as niobium.

Fig. 6. Heating unit is retracted during the forming operation. Here part has been completely formed.

Fig. 7. Douglas DC-8 jet transport receiving final touches in assembly plant before being moved to field for initial test flight.

tantalum, columbium and molybdenum. These materials can be machined, but at speeds from one-seventh to one-tenth as fast as those for conventional materials. Thus, to obtain equivalent production, manufacturing facilities would have to be expanded from seven to ten times.

Such expansion is almost out of the question, according to Northrop engineers. Further, although work is being done in the industry on machining superhard materials, Northrop people feel that the basic breakthrough in machining will come from metallurgical research, rather than from machining research. The best approach, as they see it, is to sponsor research on the heat treatment of hard materials to make it possible to machine them in the soft state, then bring them to final hardness. This is the same approach that has always been used in the past for hard materials.

Northrop has three numerically controlled Kearney & Trecker three-dimensional contour milling machines in production use. Northrop engineers state that tooling costs for numerically controlled operations are substantially below previous costs for conventional machining operations and the flow time through the machining process is also reduced by a substantial amount. These savings apply to complex parts only; on simple parts, savings are negligible. An added advantage of numerical control is that it makes possible the machining of complex parts that previously could only have been produced by hand filing—a procedure sometimes involving hundreds of man-hours per part.

Hot Forming: Much work has been done at Northrop to develop methods for forming high-strength materials. As at North American, hot forming is the rule, and some seven different methods of hot forming are currently being used in production. Northrop engineers find that with this many forming methods, no difficulty is experienced in forming any production material, including titanium alloys. Production experience has resulted in a general rule-of-thumb; the best forming temperature for any material can be roughly calculated by multiplying the melting temperature by 30 percent.

Three hot forming methods used at Northrop are of special interest. In one of these methods, "resistance heating," a horizontal stretch press is used. *Fig.* 5. An electric current is passed directly through the workpiece to heat it sufficiently for forming. Special plastics bearings provide electrical insulation for the machine proper. In a second forming method, "Calrod dies"—dies containing heating elements—are used. This method is applicable for parts that cannot be formed on a stretch press.

Perhaps the fastest and most efficient method for high-temperature forming is radiant heating. *Fig.* 6. Parts to be hot formed are placed in position on the tool in a Ceco high impact rubber forming press. A radiant heater is then extended over the part by an air-powered mechanism. The heater is equipped with 18 infrared quartz lamps of 1600 watts each. Either 10 or 18 lamps are then turned on, depending on the size of the part.

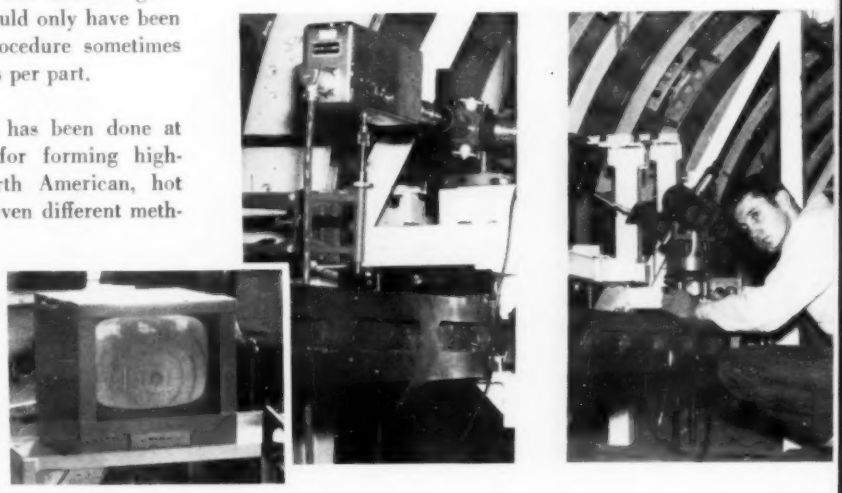


Fig. 8. Closed circuit television facilitates optical alignment of jig components. Image on television screen is shown at left.

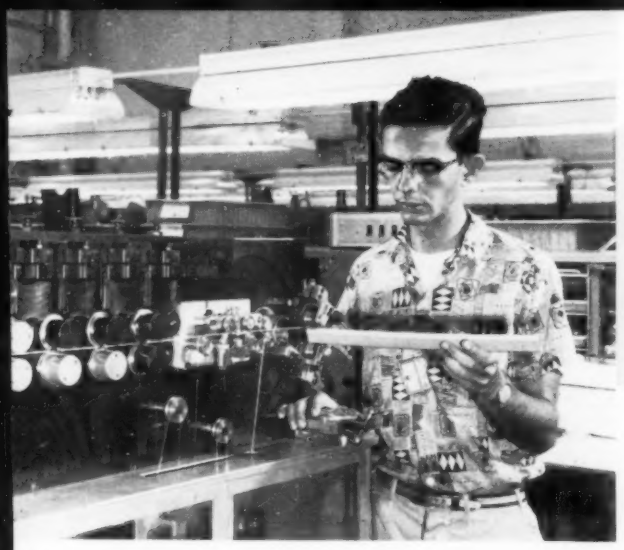
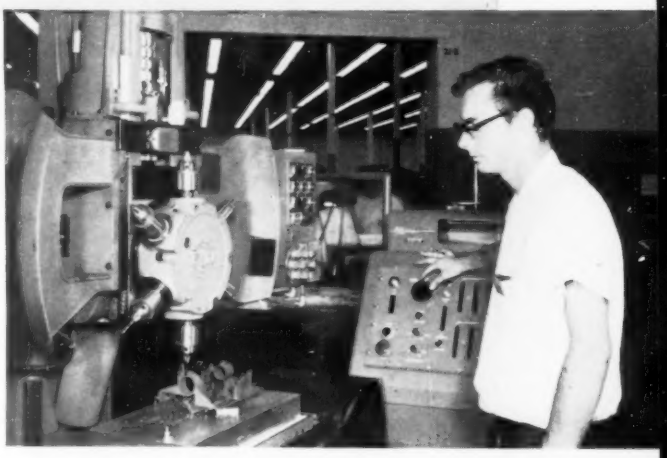


Fig. 9. (left) Hughes-designed special machine winds brass ribbon, aluminum wire and solder wire together on a mandrel to form a flexible wave guide.

Fig. 10. (below) Burgmaster tape-controlled turret drill press is used for drilling holes in a variety of small precision parts.



When the maximum allowable temperature is reached, the operator raises the hammer to dropping position, causing the lamps to be automatically turned off and to retract. The drop is then completed. Workpiece temperatures as high as 1050 F can be achieved in 47 seconds.

Plastics dies and fixtures, while not adaptable to hot forming, are being extensively used at Northrop. Northrop engineers point out that the 90 percent weight savings made possible by plastics fixtures are a significant advantage in the shop. Like North American, Northrop makes plastics tools by working directly from plaster models.

A New Welding Method: The scope of Space-Age tooling problems is indicated by the fact that there are some 154 major research and development projects in tool engineering at Northrop. A total of 38 welding methods is in current use, illustrating how specialized techniques have become commonplace in the plant.

One of these methods, known as the "moving lake" method, was developed by Northrop tool engineers to join foil materials as thin as 0.002 inch. Previously, the thinnest foils that could be successfully joined were 0.015 inch thick. In this Heliarc method, a torch is moved along a seam at 60 inches per minute. As the torch travels along, it melts a small hole or "lake" in the material. The molten metal does not flow out of the hole and it solidifies as soon as the torch passes.

Jet Transport Tooling: Long-distance terrestrial transportation in the Space Age will be furnished by jet aircraft. The Douglas Aircraft Co. recently completed test flights of their DC-8 jet transport, *Fig.* 7. Powered by four jet engines, this airplane travels at "high subsonic" speed. From a design point of view, it is a logical outgrowth from the other ships in the DC series. It has, however, many safety features made necessary by high-speed, high-altitude flight. Window frames are steel instead of aluminum, and titanium strips are located at strategic points under the fuselage skin to act as "rip stoppers." There are many more contour-machined parts than are found in conventional aircraft, and skins are made to closer tolerances. Thick skin materials make it impossible to perform trimming operations during assembly, so sheet metal parts must be made to close tolerances.

Since Douglas engineers have long experience in making transports, plus experience in making high-performance missiles, no difficulties were encountered in tooling up for production. Douglas has found that the learning curve for aircraft workers on a new job is minimized by providing good tooling.

The time from initial design to the first test flight was approximately two years. This short lead time is attributed to the fact that Douglas tool engineers work directly with aircraft designers during all stages of design. Once general specifications for an aircraft have been established—performance, overall dimensions and general appearance—perspective sketches of the entire aircraft are made. From these sketches, a general breakdown into major assemblies is agreed upon by tool and design engineers. As design progresses, the major assemblies are broken down into subassemblies and individual parts, still using the technique of perspective sketches. These sketches make it possible to visualize the impact of a given design on manufacturing

and to plan tooling accordingly. Thus tool design can progress with the design of the aircraft itself—a simultaneous effort that cuts down lead time and virtually insures that there will be few "bugs" during initial production.

Douglas tool engineers are responsible for the design of all inspection and quality control equipment. The sole function of the inspection department is to inspect, using gages and equipment specified by the tool engineering department. In this way, problems of coordinating tooling and inspection equipment are avoided.

Television Tooling: Similarly, Douglas tool engineers have developed optical tooling methods for the rigging of assembly jigs and fixtures. Optical tooling has reduced fabrication time and is more accurate than the traditional level-and-transit method of rigging because errors of observation are reduced to a minimum, regardless of the operator's skill. Also, optical tooling makes it possible to accomplish rework without moving the jig or fixture from the assembly area; no clear area around the fixture is required. The ability to accomplish rework quickly is especially important at Douglas, where several sizes of aircraft may be assembled on the same basic tooling.

Optical tooling involves establishing a line of sight by means of a microalignment telescope and a target. A precision check bar is then rigged along the jig, parallel to the line of sight. This bar supports an optical square that is used in establishing planes normal to the line of sight.

The latest innovation in optical tooling at Douglas includes the use of a small television camera on a closed circuit. *Fig.* 8. The jig builder focuses the microalignment telescope and observes the reflected image on a 17-inch television receiver. By adjusting the optical square, the reflected image of the telescope objective lens reticle may be centrally imposed on the cross hairs of the telescope. When this is done, the axis of the optical square telescope is at a 90-degree angle to the line of sight and may be used to transit a station plane.

An important advantage of the television method is that the jig builder adjusting the optical square can observe adjustments as he is making them, eliminating the need for hand signals. Further, since the image is magnified about 300 diameters, the accuracy of superimposing it over the cross hair reticle is greatly improved.

Electronics for Space: Tooling for the Space Age involves electronics as well as aircraft. At jet aircraft or rocket speeds, decisions must be made and executed at speeds far faster than the reaction time of any human pilot. At a Hughes Aircraft plant in El Segundo, complex electronic control systems—automatic pilots plus—are produced. These intricate systems contain many thousands of miniature components, packed tightly into a series of compact "black boxes." The systems are installed on fighter planes. Equipped with a radar "eye" they are capable of locking in on any airborne target, flying the airplane so as to counter evasive action, eventually delivering a knockout punch.

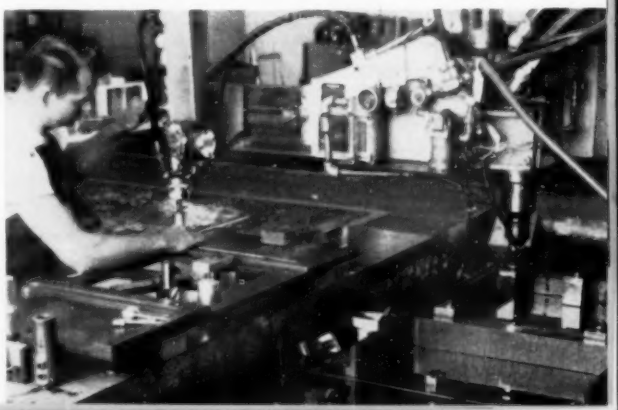
The control systems are produced in a former automotive assembly plant that was completely renovated for the manufacture of electronic equipment. A philosophy defined as "the visual controlled flow of material through men and machines" guided the redesign of the plant. The "visual" part of this philosophy is exemplified by an overhead walk from which all plant operations can be studied.

All components must be 100 percent reliable, since the control system itself is designed for 100 percent reliability. Accordingly, the receiving inspection area in the plant is nearly as large as the assembly area and is fully equipped with electronic testing devices. Satisfactory components are placed in protective packages and stored in an area between the inspection area and the assembly area, resulting in a smooth flow of parts with no backtracking. Racks in the storage area are planned to permit ready access to any individual package of parts.

Assembly work is performed on progressive lines. Individual workers may spend several hours on each subassembly, performing scores of operations. Then the subassembly is passed on to the next operator in the line for additional operations. Finished subassemblies are checked at electronic inspection stations at the end of each line.

Most precision assembly work is performed by female operators. They have greater patience than male operators, according to Hughes engineers, plus the dexterity required for delicate soldering and wiring operations. Each assembly station, *Fig.* 1, is planned for maximum operator convenience. Components are stored in individual containers, each clearly identified and within easy reach. Where

Fig. 11. Steel window frame for Douglas DC-8 is contour machined at Darco Industries. Tracer equipment is manufactured by True Trace, Inc., El Monte, Calif.



required, assembly fixtures are designed so that the work can be tilted or rotated for optimum access to all areas.

To minimize break-in periods when an operator is shifted from one job to another, each work station has been made identical to every other. Operators follow a detailed operation sheet or "Linedex" card. Thus it is not necessary to memorize each step in assembly. The card also serves as a check to see that all components have been inserted and wired.

Large assemblies requiring mechanical operations are usually built by male operators. Hughes has been a national leader in the employment of the handicapped and many of these workers are paraplegics or have other major disabilities. Hughes engineers feel that physical disabilities should not bar anyone from employment if he can handle a job and, as a matter of fact, find that persons with disabilities often have superior patience that enables them to develop unusual skill in precision work.

Mechanical Components: Mechanical components of the fire control system are also manufactured in the El Segundo plant. For the most part, these are machined from precision castings on standard types of machine tools. It has, however, been necessary to design and build a number of unusual machines for special operations. One example is a machine for winding flexible wave guides, *Fig. 9*. This machine, which operates on the same principle as a spring winding machine, automatically winds wire solder with brass ribbon and aluminum wire on a mandrel. The aluminum wire holds the wave guide in correct form. Subsequently, the wave guide is heated, bonding the brass ribbon. As a final step, the assembly is encased in a rubber jacket and the aluminum wire is removed.

Salt-bath brazing is extensively applied for the assembly of complex mechanical (nonelectronic) components such as chassis and gearboxes. These components are made up of intricate machined parts. The cost of assembling parts in a fixture and brazing them together is far less than the cost of machining an entire component from the solid. Also, the salt-bath brazing technique has eliminated the need for dozens of individual manual brazing operations. Brazing metal is inserted between mating surfaces, the component parts are clamped in a fixture and all required brazes completed in one dipping operation.

Special Machines: There are a number of foreign-built machine tools in the plant. Hughes engineers have a policy of buying machines that will do the best job, regardless of where they are made. At Hughes, there is a feeling that European machines supplement, rather than supplant, American machines. As an example, Hughes engineers cite several European-made automatic machines for high production of precision small parts. There are no American counterparts of certain of these specialized foreign machines. On the other hand, when it comes to large machines for high production of relatively large parts, American machines have no equal.

An interesting American-built machine—built to fit Space-Age requirements for manufacturing efficiency—is a numerically controlled turret type drill press, *Fig. 10*. This machine is produced by Burg Tool Mfg. Co. in Gardena, Calif., only a few miles from the Hughes plant. It is used at Hughes for drilling, boring and tapping holes in a variety of small parts. The transistorized Electropoint control system is compact, so the control cabinet can be installed immediately adjacent to the drill press. Tapes are of 10⅝-in.-wide plastic and are punched manually. Approximately 50 percent savings in tooling costs and lead time are reported, plus savings resulting from better machine utilization and reduced possibility of error during machining.

Tracer Machining: While large companies engaged in aircraft, missile and rocket work have the primary responsibility for ushering in the Space Age, their work would be impossible without the skill and facilities of literally thousands of sub-

Fig. 12. Extruded shapes are produced on 300-foot-long press.

contractors and suppliers. In the Los Angeles area alone, there are scores of small shops producing small lots of parts and assemblies for major contractors. Typical of these is Darco Industries, Inc. in El Segundo. The stock in trade of Darco and similar organizations is flexibility. Companies like North American, Douglas and Lockheed call on Darco for contour machining, specialized sheet metal fabrication, welding, tool design and assembly production. Indeed, the attitude of most subcontractors is "We can do anything."

Such companies provide a reservoir of manufacturing facilities and know-how that is often an important factor in the success of major aircraft manufacturing programs. A typical current job at Darco is the manufacture of window frames for the Douglas DC-8 jet transport. These frames are machined from solid blocks of 4140 steel. First the part is torch cut from the block, then they are rough and finish machined, using a three-dimensional contour tracing head, *Fig.* 11. Darco also used contour machining techniques to hog out plates, billets or slabs to complicated engineering designs for test parts, tooling tryouts, or in cases where forging dies are too costly or are not obtainable. In some cases, Darco has been able to duplicate forging dies with tracer equipment.

Extrusion: One of the largest Space-Age suppliers on the West Coast is Harvey Aluminum, located in Torrance, Calif. The company manufactures extruded structural shapes and extruded

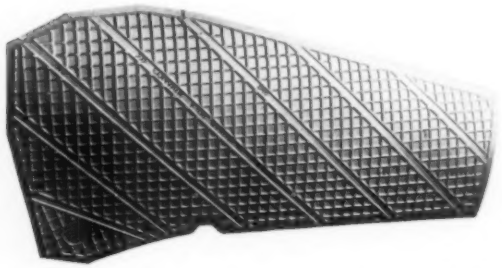


Fig. 13. Wing tip of supersonic jet fighter. Waffle pattern is chemically milled. Part size is 36 by 72 inches. Close tolerances are held.

parts, forgings and screw-machined parts. Structural shapes for aircraft, missile and commercial needs are produced on a 12,000-ton press that has an over-all length of 300 feet and weighs 4 million pounds, *Fig.* 12. This press can extrude aluminum sections from ingots 32 inches in diameter and 75 inches long. The most important application of these sections in the aircraft and missile industry is in furnishing raw material for parts. This eliminates excessive chipmaking required when machining, say, an L-shaped part from a square block. The press is also capable of extruding titanium and steel.

Chemical Milling: Chemical milling is another process that is gaining in importance. This process was originally developed by North American and is now utilized by several smaller companies that specialize in production of chemically milled parts. One of the leaders in this field is Chemical Contour Corp., Downey, Calif.

The chemical milling process is essentially simple. An entire part is coated with an acid-resistant substance (CC Corp. uses neoprene). The coating is baked on, then the area to be milled is marked, using a plastics or metal template. The mask is cut off to expose areas to be milled. Neoprene peels off easily. The part is then dipped in a tank of solution and held until the proper depth of etch is reached. Etching takes place at the rate of one mil (0.001 inch) per minute. Maximum depth of etch from a practical standpoint is one-half inch, although it is theoretically possible to etch to any desired depth. A typical part is shown in *Fig.* 13.

Some undercutting takes place around the edge of the mask, but this can be compensated for by making the masking template slightly oversize so that the neoprene coating extends over the edge to be etched after cutting. Any aircraft metal—including stainless steels, titanium and magnesium-thorium alloys—can be chemically milled. The only "secret" involved in the process is the selection of a suitable etchant. Some companies spray the mask on; others use dip techniques. Chemical Contour Corp. engineers prefer to flow the neoprene on from a hose. Any pinholes that appear during baking are covered with an adhesive-backed lead foil.

Chemical milling is thus one method of circumventing machining problems caused by "superhard" alloys. It is used to "machine" areas that cannot be reached with conventional cutting tools. It provides a simple means of tapering airfoils—the airfoil is gradually lifted from the tank. Another important application is weight reduction.

An interesting recent application of the process is reducing the wall thickness of an area in a component for the Vanguard satellite to 0.005 inch. The purpose of this operation is to weaken the wall so it will blow out under an internal gas pressure of 20 psi.

To summarize the impact of the Space Age on tool engineering: New materials, more stringent accuracy and reliability requirements, and greater complexity of product are the most important trends. At the onset of the Space Age, tool engineers have yet to find a problem that cannot be solved by diligent research, the application of sound engineering principles—and hard work.

Egg-Crate Inspection System cuts rejects

By William R. Baker
Director of Quality Control
Parker Aircraft Co.
Los Angeles, Calif.

A quality control system developed by Parker Aircraft provides for early discovery and immediate reporting of error sources, resulting in increased production and fewer rejects.

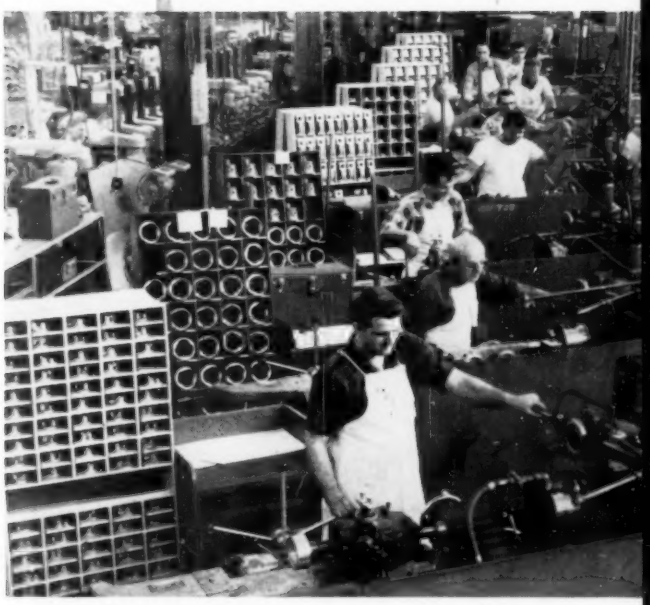


Fig. 1. Manufacturing with the egg-crate system. Parts are contained in racks resembling egg crates and are gaged by the machine operators.

OFTEN INSPECTION SYSTEMS which are excellent in preventing delivery of unsatisfactory parts to the customer are inadequate for pinpointing the exact cause of rejects. For short production runs, this delay sometimes allows parts to go through the entire manufacturing operation before corrective action is started. Even with long production runs, early detection and location of an error source is still essential to economical manufacturing.

The "egg-crate" inspection system assigns to the machine operator the task of running a continuous check on his own work, *Fig.* 1. This takes additional operator time but the results are worth the extra effort. In one case, Parker Aircraft Co. switched to the egg-crate system and immediately dropped its customer rejection rate on a complex hydraulic control mechanism from 10.9 percent to 0.70 percent. This reduction repaid the cost of additional operator inspection time many times over.

The outstanding feature of the system is simplicity. No expensive equipment or extensive reorganization of existing facilities is required to put the system into action. All that is required is that each machine operator systematically inspect his work and record findings in a methodical manner.

The egg-crate system not only increases the quality of the end product, but greatly assists the tool engineer. Accurate data is obtained on tool wear factors and machine capability. Errors in planning and tooling can be spotted immediately, and the source of trouble is located quickly without having to examine the entire production line. Experience has shown that the tool engineer is seldom, if ever, needed after the first 25 parts have been produced, during which time the tooling has been proved out.

Abstracted from Paper 179, "Egg-crate Sampling as an Aid to Production Engineering," to be presented at the 26th ASTE Semiannual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

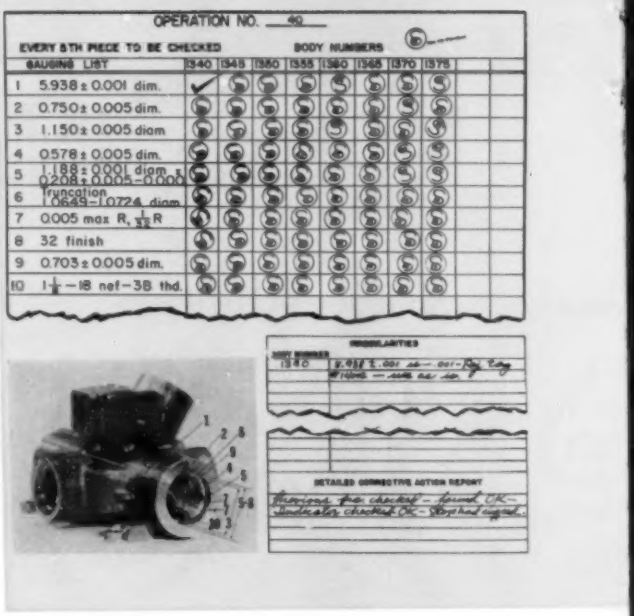

OPERATION NO. 40
EVERY 5TH PIECE TO BE CHECKED
BODY NUMBERS
GAUGING LIST
1340 1345 1350 1355 1360 1365 1370 1375
1 5.938 ± 0.001 dim.
2 0.750 ± 0.005 dim.
3 1.150 ± 0.005 diam
4 0.578 ± 0.005 dim.
5 1.188 ± 0.001 diam x 0.208 ± 0.005–0.000 truncation
6 1.0649–1.0724 diam
7 0.005 max R, 1/32 R
8 32 finish
9 0.703 ± 0.005 dim.
10 1 1/8 – 18 nef – 3B thd.
IRREGULARITIES
DETAILED CORRECTIVE ACTION REPORT

Fig. 2. Gaging list gives complete information on all inspection measurements. Part is certified to meet requirements by stamp in appropriate square. Check mark means part failed inspection.

The Egg-Crate System: The egg-crate system gets its name from the rack that is used to contain parts between machining operations. *Fig.* 2. It is divided into cells and resembles an egg crate. When parts are ready for machining, they are delivered to the machinist in the rack. After each part is machined, it is returned to its own cell. Each part remains in its cell throughout the entire manufacturing process except during machining and checking operations.

Proper planning is necessary before any design is released to production. When tooling requirements are determined and process charts made up, they are reviewed in detail by a committee composed of representatives from quality control, tool engineering and production. Sequence of operations, checking equipment and frequency of checking are reviewed in detail. In this way many potential problems are eliminated before they arise.

The machine operators check parts with a regular frequency determined through standard statistical procedures. In one case, for instance, the operator checks every fifth part. If any part is rejected, all parts made since the last inspection are checked. No more than five parts can be machined improperly and the cause is determined immediately.

In manufacturing one type of hydraulic valve, valve bodies are received in the as-cast condition. They are first inspected for defects as required by military specifications. Prints and routing orders are checked for possible revisions to insure that the bodies will be machined according to the latest specifications. Chemical and physical analyses of the parts are reviewed to be sure that they meet specifications. If the bodies pass preliminary inspection, they are ready for machining.

Each part is next placed in an egg-crate rack. As each part is put in its cell, it is stamped with a number. The first casting placed in the rack is stamped number one, and the rest in numerical order. These numbers are also put on the purchase order for future reference. The latest engineering, routing, and process drawings are attached to each rack. The rack is then released to production.

Machining of each body is done in numerical sequence. The machinist starts with part one and works in order to part 100, or to whatever number of parts there is in a single rack. A gaging list is included in the process drawings attached to each egg crate.

Gaging List: The main purpose of the gaging list is to provide the inspection department with an accurate progress and condition report. An example of a gaging list is shown in *Fig.* 2. This list shows the machinist the dimensions that must be checked to maintain quality.

Figures in the top row of the gaging list are part numbers. All entries in the left column show the dimension which must be checked. When a valve body meets all requirements, the operator's stamp is entered in the proper square. If the part does not meet the requirements, a check is put in the square. When the machinist finds a part that does not meet specification, he checks all parts machined since the last inspection.

Rejected Parts: When a part fails to pass inspection, it is reworked as soon as possible. If rework is impossible, the part is painted red and replaced in the rack. The actual condition of the part, along with the part number, is recorded on the back of the gaging list.

Leaving rejected parts in the egg crate serves several purposes. First, it gives the machinist an indication of the quality of his work. Naturally, a good worker does not want his rack filled with rejected parts. Second, it permits the foreman to isolate the cause of a high rejection rate. He can immediately determine which operator and which machine are responsible. This allows adjustments to be made, if necessary. Third, it allows the production planner to estimate how many acceptable parts there will be at the end of machining. Fourth, it simplifies the work of quality control in determining the reject percentage.

Random Inspection: During machining, inspectors spot check parts along the line. The inspector is also responsible for seeing that the proper gaging lists are at each operation. Furthermore, he is responsible for maintaining detailed corrective action reports on the backs of the gaging lists, including tool changes, fixture correction and operator instruction.

When machining operations are completed, a review of the gaging lists and rejects is made. Scrap parts are removed from the egg crate and visual inspection is performed on the remaining parts to see if any damage has occurred during handling. If no damage has occurred, the parts are released.

Gages: In order to provide a maximum amount of useful data on tool wear factors and machine capabilities, variable checking equipment is used quite extensively, *Fig.* 3. When a part is out of tolerance, the amount of variance is recorded on the gaging list. Therefore, time between tool changes can be predicted.

Fixed gages such as go and not-go, are not desirable on short runs. They frequently cause trouble and they do not allow the engineer to collect accurate information on tool wear factors. Frequently, when plug gages are used, rejected parts may actually be acceptable. In other words, they may be slightly over or undersize and still within limits, but the type of checking equipment used does not allow this to be determined.

The main argument presented against this system is that checking is done on the line by the operators. Since time is spent checking, the operator cannot produce as many pieces. In many cases, however, the total plant productivity goes up, due to a decrease in the number of rejections.

Furthermore, the machine seldom stops. Inspection is carried on as the machine is working. Since the system definitely reduces the number of rejects —up to 90 percent in some cases—the machinist spends more of his time producing acceptable parts. In order to reduce the time required for checking, however, the best inspection tools and the simplest means of checking must be provided.

Work Standards: In order to put the egg-crate system into effect, work standards must be revised. At every operation where an inspection must be made, the time to produce each part must be changed in order to account for the time spent on inspecting.

Close cooperation between the work standards department and quality control is essential to determine the proper standards that are to be used. Quality control first should check with all production supervisory personnel to determine the minimum amount of inspection to be enforced by production supervision. Then, quality control determines the frequency of inspection. After the frequency of the inspection cycle has been determined, the standards department either accepts or opens it up for discussion prior to the determination of piecework rates or standards.

A point to keep in mind is that this system works best in a process where the operator is required to do a number of operations. In machining valve bodies, for example, one operator may perform as many as 12 different operations. If the operator performs only one or two operations, an adjustment is made on frequency checks.

The machinist must be made to realize that the system is not being put into operation to find out how many mistakes he makes, but rather to increase the quality of the product he turns out. He must be shown that he will be able to take more pride in his work because he will learn his own capabilities.

Furthermore, it should be emphasized that he will learn the use of new tools as he checks his work, and that this will make him a more valuable man. High morale based on recognized good workmanship will, in most cases, outweigh any other incentives that management can offer.

Results: On the surface, this system might appear awkward and laborious. Actually, it becomes very simple after it is put into operation. Not only are fewer inspectors required in the egg-crate system, but there is also a large reduction in customer rejection. An improvement in over-all efficiency of manufacturing is brought about by improved techniques accompanied by reduced costs for each unit produced.

The egg-crate system has been proven to be highly effective where low quantities of complex parts are being produced. In order to have this system operate most effectively, the quality control department needs the help of tool engineering, especially in the planning and early production stages. In return for this cooperation, tool engineers will find that they will obtain valuable data and assistance from quality control to help iron out many of the difficult production problems, and in addition will be assured of products of high quality.

Correction: In Louis D. Martin's article "Over-Pin Measurements of Worms" published in our July issue, there is an unfortunate typographical error in *Fig.* 6 on page 54. The formula should read:

$$M = \frac{d}{\sin \phi_n} - \frac{t_s}{\tan \phi_n} + d + D$$

We hope the omission of the minus sign was detected by readers using the formula.—ED.

ERECTOR SET TOOLING for lower missile costs

By T. F. Vajda

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Tools built from standard kit components are saving time and money in missile manufacturing. The author describes some typical examples of how short-run production costs have been reduced with this economical tooling.

SMALL-LOT PRODUCTION with demands for reliability when producing missiles have forced the tool engineer to become as visionary as the design engineer. Tooling, methods and ingenuity have become synonymous terms.

With missiles operating in areas where unknown quantities, e.g., heat dissipation in a vacuum, are prevalent, the designer must base his design assumptions on the current theories of expected performance under these conditions. Hardware must be designed to meet and not exceed these predictions if critical weights are not to be exceeded.

To obtain this desired performance, the engineer must be sure to produce the hardware identical with the requirements of the blueprint. Unspecified tolerances resulting from out of tolerance conditions introduce possible causes for failure which were not anticipated. However, the production of component parts to exacting tolerances and specifications is costly unless creative thinking is applied to keep costs at a minimum.

Conventional tools should be used where the production is large and schedule time is sufficient to warrant their purchase. In other instances, short lead time and low production force the engineer to find more economical tooling. One answer to this problem is the use of standard components in kit form which can be fabricated into tooling in a short period of time.

A good example of this erector set type of tooling is the die shown in *Fig.* 1 which forms a workpiece blanked on conventional tooling. Although conventional in appearance, this die is constructed of separate pieces assembled similar to a sandwich. This tool produced a few thousand parts which were sufficient for the particular job. It does not have the service life of the conventional mass production die but is adequate for the short production runs found in the missile field.

Tooling sets to make this type of tooling are available from various sources. The set shown on *Fig.* 2 consists of a multitude of accurately machined parts such as bases, clamps, slides, riser blocks and other necessary hardware to assemble short-run tooling in a relatively short time.

Drilling is another area where the use of erector set tooling is saving fabrication time and money. To drill six small holes in a hydraulic part, an indexing head is used to hold the part in a collet

Abstracted from Paper 183, "Tooling Electronics for the Vacuum of Space," to be presented at the 26th ASTE Semiannual Meeting. Copies of the complete paper can be purchased from Society Headquarters.

Fig. 1. Form die constructed of building block components. Parts in the foreground were blanked for this operation on a conventional punch press die.

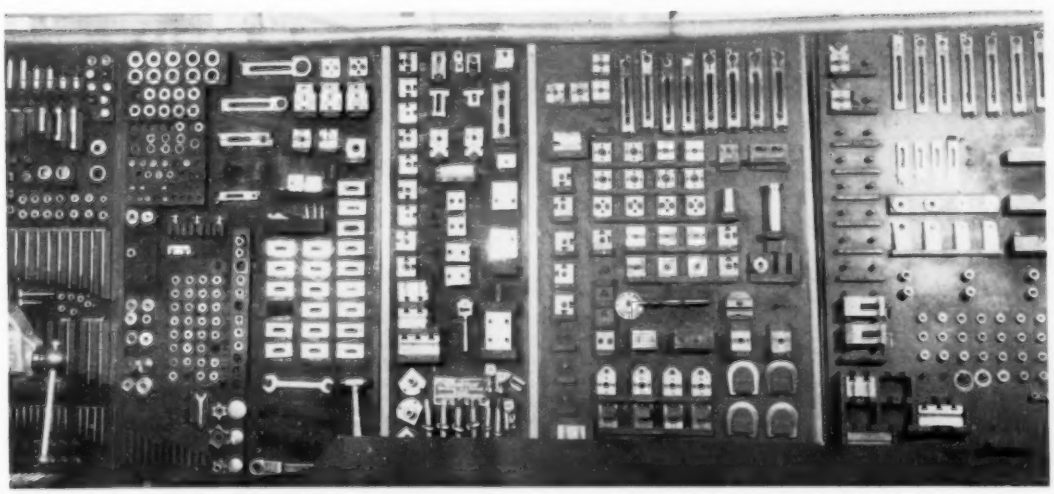

Fig. 2. Tooling erector set used in the fabrication of short-run tooling. Various sizes of standard components are mounted on a tooling board for easy access. Shelves are provided for the heavier parts such as vises, clamps and bases.

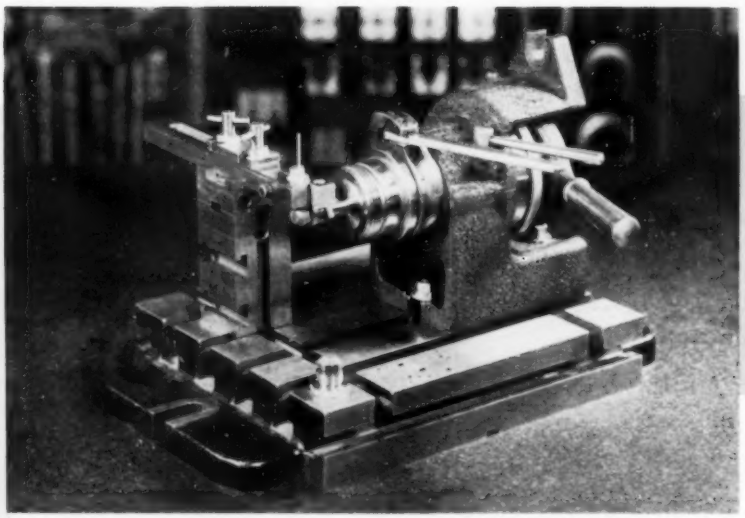

Fig. 3. Indexing fixture for drilling six holes in a hydraulic fitting. The workpiece is shown in the foreground.

Fig. 4. Drill fixture mounted directly on the drill press table. During drilling, the bushing is manually held over the workpiece and is located on the OD of the part.

type fixture, *Fig.* 3. The drill bushing for the holes being drilled is mounted on riser blocks in relation to the axis of the part. Total assembly time of this fixture is about one hour. In other cases, a vise has been found to be the easiest method of holding a workpiece relative to the drill bushings. Tools of this type have been assembled by personnel acquainted with the kit in less than one-half hour.

Another method of using these components for drilling applications is found in mounting the fixture parts directly on the drill press table. One setup of this kind, shown in *Fig.* 4, required only two hours to prepare for production. The drill bushing in this fixture is mounted in a sleeve and the workpiece is located relative to the drill press spindle. During drilling, the bushing sleeve is manually held over the part being drilled. In this way, no bushing plate is required and, therefore, no expensive boring operations to attain the accuracy required for this operation.

A logical extension of this thinking is the application of these principles to complete drilling machines. A few tools for the simple multiple drilling operations have been built on the standard bases using automatic air drills. In one particular case, four holes are drilled simultaneously in the workpiece. A variety of parts with the same center distance on the holes are drilled in the setup shown in *Fig.* 5. Assembly time for the tool was 20 hours. The tool is capable of drilling the four holes in 10 seconds, including loading and unloading.

Milling is another of the basic metalworking operations where fixtures of this type are useful for holding down construction costs. The use of the standard base with the fixture keys for location facilitates their setup in the milling machine. Fixtures requiring the location of the part at an angle to the axis involve additional time for construction since the angular relationship must be accurate. Assembly time for the tool illustrated in *Fig.* 6, with an angular face, was approximately three hours. Possible variations of the basic fixtures for milling are limited only by the ability of the builder to use the kit components and his imagination.

To effectively use the tool kit, it is necessary for

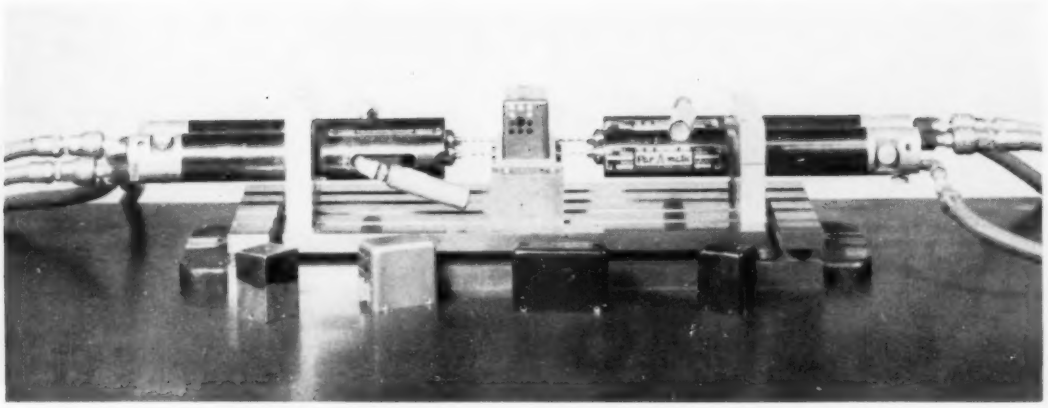

Fig. 5. Automatic drilling setup for four holes in the workpieces shown in the foreground. Total process time including loading and unloading is 10 seconds.

the builder to have a print of the workpiece and familiarity with the basic kit parts. Often, a sketch from the tool engineer will reduce the trial and error of the toolmaker. Once the tool has been made, it is photographed in as many views as necessary to speed rebuilding, if needed again.

Records of the fixtures are kept with part prints for possible future use since the fixtures are usually dismantled when the current production run is completed. Reassembly of a once developed tool rarely takes more than one-half hour.

It has been established that the missile field is dealing in areas where much knowledge is lacking, where the demands of engineering are exactness, where time is of the essence and where the number of items produced is usually small. To keep pace with these demands in manufacturing, the conventional approach of building tools will not suffice. Greater demands for craftsmanship are being made on the tool builder because of the requirements for exactness in a minimum of time. Tools must be manufactured as simple as possible to do the required job. Often, building block tool sets are a means of obtaining the desired results.

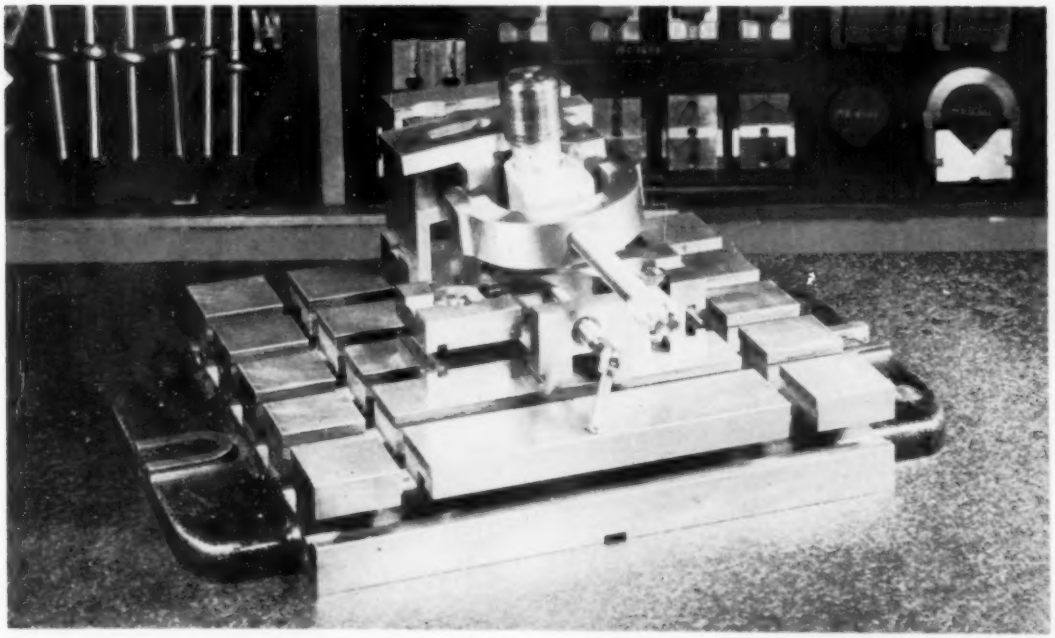

Fig. 6. Fixture for straddle milling a workpiece clamped in the building block fixture. Three hours were required to construct this fixture since the accuracy of the angular relationship of the milled section to the OD of the part had to be inspected for correctness before use of the tool.

Ultrasonic Welding comes of age

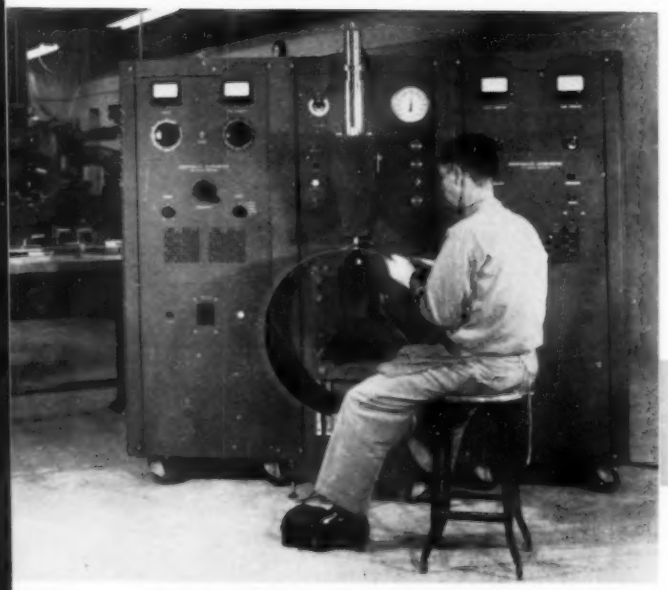

Fig. 1. High-strength, pressure-tight, ultrasonic seam weld being made in a 24-inch-diameter cylinder of 0.050-inch-thick 2024-T3 Alclad aluminum alloy.

By J. Byron Jones, President
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Improvements in equipment and tooling have changed ultrasonic welding from a laboratory curiosity to a versatile and effective production method. Applications, equipment, tool tip design and strength data are covered in this article.

ULTRASONIC WELDING is a method for bonding similar and dissimilar metals by the introduction of vibratory energy into the metals in the area to be joined. Production experience has shown that this joining method can often produce more satisfactory junctions than can be achieved by more conventional methods. In many cases, cost savings are substantial. Since the introduction of ultrasonic welding a few years ago, equipment of high capacity has been developed, *Fig.* 1. Basic information on the process is given in THE TOOL ENGINEER, December, 1957.

Typical Applications

The simplest application of ultrasonic welding is the production of lap joints between sheets of metal, either by single spots, by overlapping spots to produce a continuous bond, or by a truly continuous weld produced with a rotating welding tip. Modifications of the equipment and the tooling have resulted in successful use of this technique for joining a variety of part shapes and materials.

One of the first successful specialized applications of ultrasonic welding was the attachment of a relatively small rib to a heavy aluminum rod, as shown in *Fig.* 2. The rib was welded to the rod in a spiral pattern by means of overlapping spotwelds.

In another application, fine resistance wire is welded across two copper lead wires. The ultrasonic process produces sound mechanical joints and consistent electrical resistance across the bridge. A photomicrograph of this joint, shown in *Fig.* 3, reveals a good metallurgical bond.

A heat exchanger configuration is illustrated in *Fig.* 4. Here a corrugated aluminum sheet six mils thick was continuously welded at the bottom of each corrugation to a sheet of 0.072-inch aluminum. Continuous-seam welds in materials of this thickness have been accomplished at rates of 25 feet per minute.

Abstracted from Paper 152, "Ultrasonic Welding Techniques," to be presented at the 1958 Semiannual Meeting. Copies of the complete paper are available for purchase from Society Headquarters.

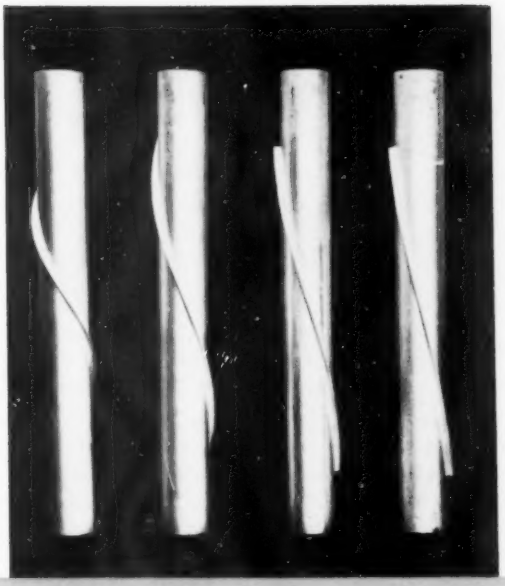


Fig. 2. Small aluminum rib, spirally welded to two-inch-diameter aluminum rod by means of ultrasonic overlapping spot type welds.

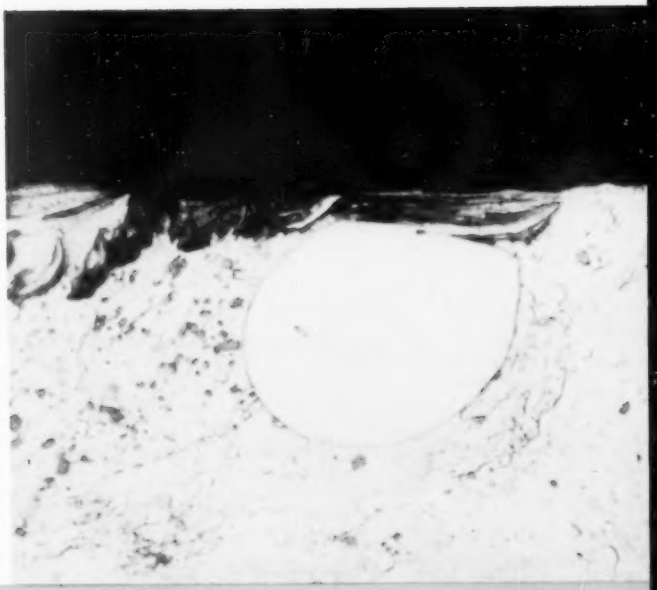


Fig. 3. Photomicrograph of 0.0015-inch diameter platinum-alloy resistance wire ultrasonically welded to copper lead wire. Magnification, 900X.

Etched stainless steel sheet is often used in the fabrication of strainers, and ultrasonic welding is particularly effective in joining such materials as illustrated in *Fig.* 5. Before welding, the 6-mil-diameter holes in the strainer were lined up with fine wires as "dowels." The holes in the welded area are just as clear and open after welding as before, while good bonds are obtained in the material between the holes.

Stranded aluminum wire is shown welded to two copper terminals in *Fig.* 6. The welding of copper to aluminum in a variety of configurations can be easily accomplished by ultrasonic welding, thus effecting saving in both weight and cost.

Ultrasonic seam-welding of cylinders of 2024-T3 Alclad aluminum alloy is shown in *Fig.* 1. These seam welds consist of overlapping spots. Since no electric current flows through the joints, ultrasonic spotwelds can be overlapped without difficulty. The seam type bonds produced in this manner are both pressure-tight and of high structural integrity.

An example of a waffle type sandwich structure is shown in *Fig.* 7. By ultrasonic welding, relatively large areas of waffle filler can be bonded to inner and outer skins because fairly large weld spots can be made even in thin materials. In many structural

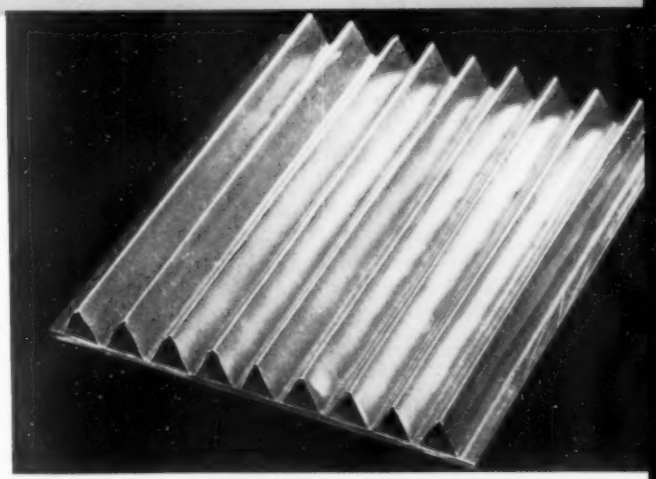


Fig. 4. Heat exchanger configuration consisting of 0.006-inch thick aluminum fins attached to 0.072-inch-thick aluminum plate by seam welding.

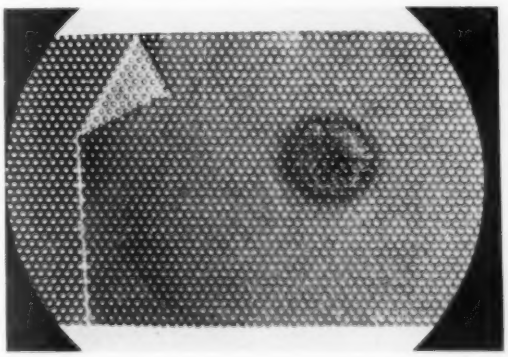


Fig. 5. Ultrasonic spotweld in etched stainless steel strainer material. The material was not cleaned after welding; however, holes in weld zone are clear and open.

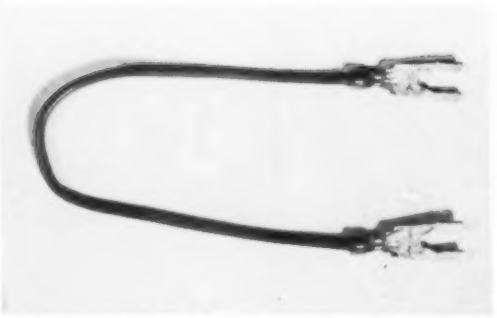


Fig. 6. Stranded aluminum wire ultrasonically welded to copper terminals.

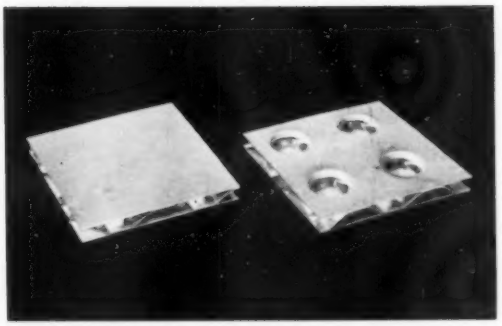


Fig. 7. Ultrasonically welded waffle type sandwich structure of 2024-T3 Alclad aluminum alloy sheet.

applications such as this, welds of large area are of considerable advantage.

Types of Welding Equipment

In order to accomplish ultrasonic welding with such a variety of geometric shapes, it has been necessary to develop several types of welding equipment. Basically such equipment includes a transducer-coupling system for generating vibratory energy and delivering it to the weld zone, a support for the workpieces, a means for applying clamping force to the weldment, and an electronic generator to supply high-frequency electric power to the transducer. The entire system is designed to operate at a particular vibratory frequency. Although it has been established that ultrasonic welding can be accomplished over a very broad frequency band, greatest attention has been given to developing equipment operating in the range between 3000 and 85,000 cycles per second.

The transducer-coupling system is a vital part of an ultrasonic welding system. The transducers used in the equipment described are laminated stacks of thin-gage nickel sheet, which serve to convert alternating current from the generator into elastic vibration. This vibration is then delivered through special coupling systems into the weld zone. There are two important requirements for a transducer-coupling system if it is to perform satisfactorily. First, the system must be force-insensitive; in other words, when force is applied to the weldment, there should be no significant shift in the resonant frequency of the system. Second, for high efficiency relatively little energy should be lost through the mounting system that supports the transducer-coupling.

One of the earlier developments was the mass-reed-wedge transducer-coupling system. This type of system is used in several of the larger ultrasonic spot type welders. The clamping force on the weldment is applied hydraulically.

A 4000-watt ultrasonic welder is shown in *Fig.* 8 which in many respects resembles a resistance type spot welder. The lower support arm can be adjusted to several positions, giving flexibility to the welder. In the lower positions, special anvil arrangements can be used to accommodate various geometries.

A lateral-drive transducer-coupling system is shown in *Fig.* 9. In this case the clamping force is applied through bending of the transducer-coupling assembly. The anvil configuration can also be varied considerably to accommodate special parts.

Portable welding heads using the same basic lateral-drive system can be made to fit into many assembly arrangements. *Fig.* 10 shows the design of one such portable welding head. As with other types of welding equipment, many variations can be designed into these portable heads. Furthermore, they can be readily built in sizes to accept 2000 and 4000 or more watts of high-frequency electrical energy and still be extremely portable.

Ultrasonic continuous-seam roller type welders have been developed. The diagrammatic arrangement is shown in *Fig.* 11. Such units also use the

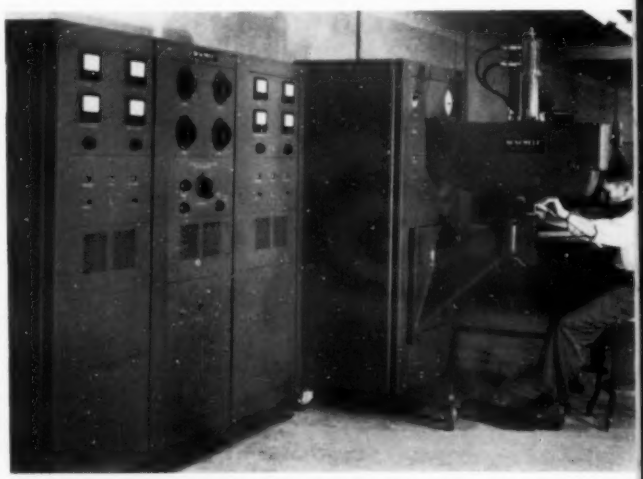


Fig. 8. Four thousand watt ultrasonic welder. Power unit shown at left is part of the complete welder.

Typical Strengths of Ultrasonic Single-Spot Welds

Name of Material	Type of Material	Sheet Gage (in.)	Tensile-Shear Strength* (lb)
Aluminum	2024-T3 Bare	0.063	1290 ± 60
Aluminum	2014-T6	0.063	1310 ± 120
Aluminum	2020-T6	0.040	1240 ± 50
Aluminum	7075-T6 Alclad	0.050	1540 ± 90
Mild Steel	1020	0.020	500 ± 20
Stainless Steel	Type 301	0.025	1040 ± 70
Stainless Steel	17-7 PH	0.020	668 ± 110
Molybdenum	Powder Metallurgy	0.025	430 ± 50
Molybdenum	Arc Cast	0.025	360 ± 40
Inconel	—	0.010	170 ± 70
Inconel	—	0.020	220 ± 105
Titanium	A-110AT(5 Al-2.5 Sn)	0.028	1950 ± 120
Titanium	C-120AV(6 Al-4 V)	0.025	1230 ± 60
Titanium	C-110M(8Mn)	0.032	1730 ± 200
Zircaloy-2	—	0.020	615 ± 20

*Average value with 90 percent confidence intervals.

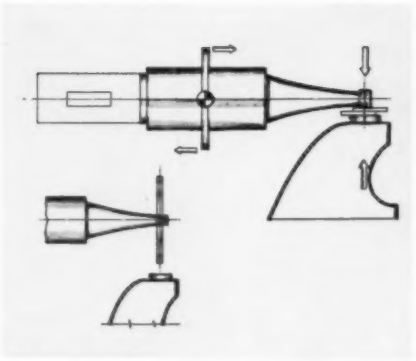
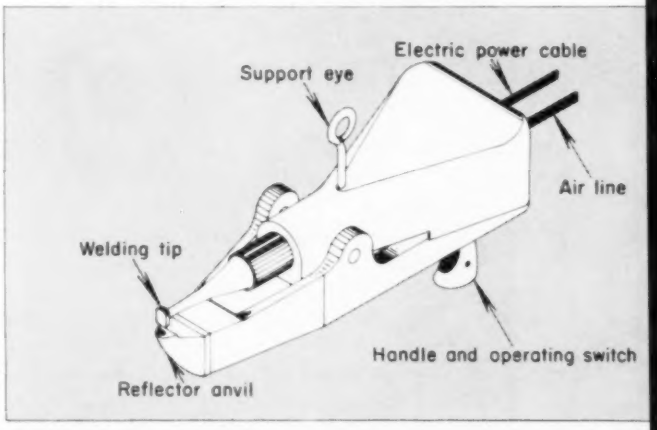


Fig. 9. Diagram of ultrasonic lateral-drive transducer-coupling system. Free-reed tip shown at lower left is used to obtain vertical clearance required for some applications.

Fig. 10. (below) Portable ultrasonic welding head. The design can be varied to suit the geometry of the weldment.



lateral-drive system but, in this case, the transducer-coupling system must rotate so that the tip travels along the workpiece at a speed to match the traversing speed of the weldment. A roller type welding head having a disk tip is shown in the lower left-hand corner. Such a tip provides the additional clearance required for many weldment geometries.

Seam welds produced with ultrasonic equipment are not intermittent. The vibratory power is applied continuously. The work either passes between rollers, one or both of which may be transducer-coupling systems, or it is carried under one transducer-coupling system on a table. The seam welds thus produced are continuous and leak-tight.

Special Tips and Tooling

The diagrams of the various types of equipment have included some special tip arrangements such as the reed tip in *Fig.* 9 and the disk type tip in *Fig.* 11. Other special tips have been designed for welding unusual geometries. Welding tip design requires careful acoustical engineering in order to retain the correct resonant properties at the design frequency of the equipment.

For most applications the tips are either spherical or cylindrical in shape, and the energy is introduced into the weldment by a kind of friction drive; that is, friction is possible between the tip and the adjacent surface of the weldment. There is also a different type of tip known as the positive-drive tip. Here the tip rests on the sloping sides of a rib being welded to a hollow tube, producing a positive drive which is altogether independent of friction between the tip and the rib. As also shown in this diagram, there is no reflector anvil below the area being welded. If the tube is very thin-walled, an internal mandrel is required. However, by properly support-

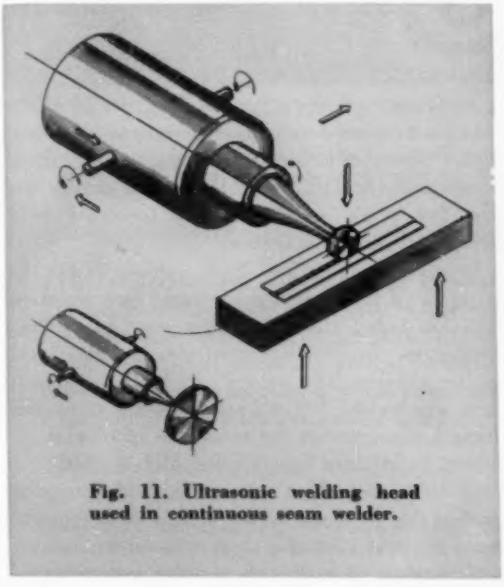


Fig. 11. Ultrasonic welding head used in continuous seam welder.

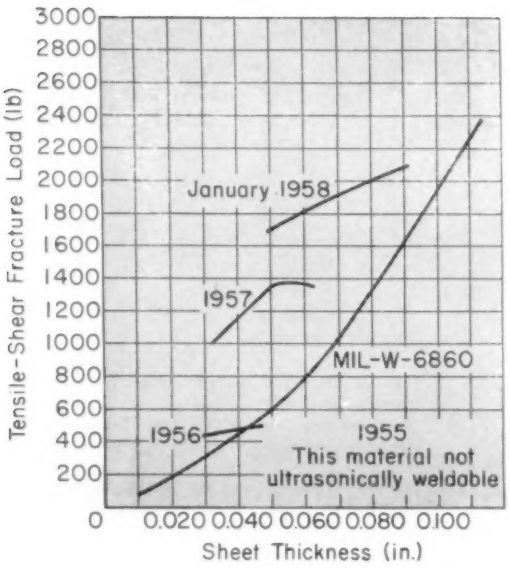


Fig. 12. Strength of single-spot welds in 2024-T3 Alclad aluminum alloy has increased continuously as welders with greater power have been made available.

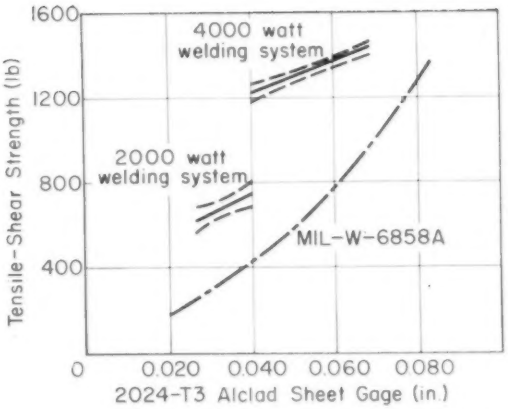


Fig. 13. Average weld strength (solid lines) with 90 percent confidence limits (dotted lines) for ultrasonic single-spot welds in 2024-T3 Alclad aluminum alloy sheet. Broken line shows minimum resistance spotweld strength required in specification MIL-W-6858A.

ing the outside of the tube in clamps as shown, no internal support is necessary even for relatively light-walled tubing. This system was used to produce the rib-to-rod weldments of *Fig.* 2.

In another case in which two long lead wires were joined to two short terminal post wires, both joints were accomplished simultaneously by using specially engineered tip and anvil configurations. With this tooling, copper wires covered with Formvar type insulation have been welded to copper terminal posts. Strong mechanical joints as well as good electrical conductivity are thus achieved.

Engineering Data

As a result of improving the detail design of the various transducer-coupling systems and providing higher power capacities, substantial improvements in ultrasonic welding have been made during the past few years, as revealed by increased weld strength in various materials.

Progress from 1955 to 1958 is shown in *Fig.* 12 in terms of the strengths of single spot welds in 2024-T3 Alclad aluminum alloy sheet of various thicknesses. In 1955 this particular material could not be ultrasonically welded. In 1956, 0.040-inch sheet was welded but it barely met the minimum strength requirements for resistance spot welds indicated in Military Specification MIL-W-6860. By 1957, 0.063-inch sheet was welded with strengths considerably in excess of the MIL-W-6860 requirement. Early in 1958, this sheet material was welded in thicknesses of 0.090 inch and the spot strengths substantially exceeded the military specification requirement.

The effect of increased power is illustrated in *Fig.* 13, which indicates the results obtained in welding 2024-T3 Alclad aluminum alloy sheet with a 2000-watt welder and with a 4000-watt welder. The heavy black represents average values, while the dotted lines on each side represent 90 percent confidence limits, or the limits within which 90 percent of the weld strengths are expected to fall.

Strength data obtained for ultrasonic single-spot welds in various types of materials is summarized in the accompanying table. In addition, engineering studies have been performed with varied spot-weld spacings ranging from widely spaced to overlapping spots. Other data indicate that edge distance is unimportant and that welds can be placed at the edge of the material without reducing the spot strength. In this way, weight can be saved by designing joints with a minimum of sheet overlap.

Recent progress in ultrasonic welding has resulted from several factors:

- New and improved transducer-coupling systems permit more energy to be delivered into the weld zone
- Spot type welding equipment with capacities up to 8000 watts has been developed, enabling heavier gage materials to be welded
- Equipment for truly continuous welding has been developed in various sizes and power capacities for handling the thinnest types of foil as well as light-gage sheet.

Other transducer-coupling systems are under development for handling special geometric shapes. This broad range of ultrasonic welding equipment types, combined with the special tips and tooling designed for specific geometries, is rapidly broadening the areas of application of ultrasonic welding.

precision forgings minimize machining

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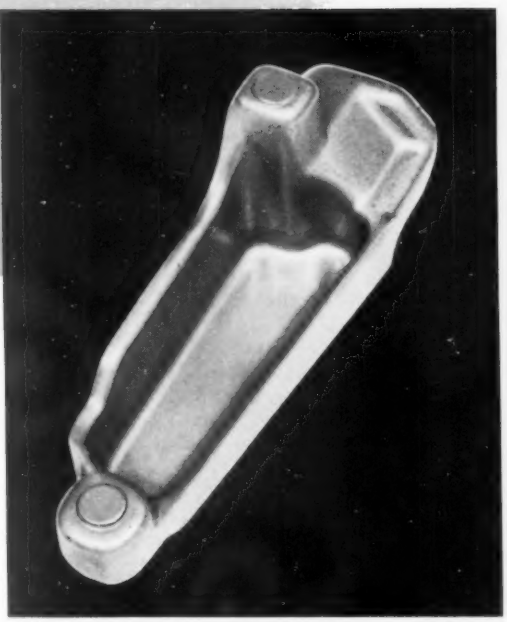

Fig. 1. Precision forging of an aircraft part. Only a minimum of machining is required to produce a finished part. No machining is required in the pocket or on the thin walls which are made with no draft.

Thermal resistant alloys require special tools, machines and methods to obtain the finishes required for aircraft. Precision forging of these alloys has reduced machining to a minimum since parts are forged to size with no excess stock.

WEAPON SYSTEM AIRFRAMES now in design must, of physical necessity, be made of thermal-resistant high-strength materials. These include new corrosion-resistant steel alloys, hot-work die steels and heat-treatable titanium alloys. Use of these materials poses many problems which must be solved by tool engineers and manufacturing personnel if the weapon systems are to evolve from drawing board to a flying craft within a scheduled time span. Poor machinability, high material costs, high tool mortality are some of the problems involved. Also, extremely close tolerances are required for the high-speed aircraft.

Published reports suggest that with steel replacing aluminum in the airplane, the art of machining airframe components has been set back about 25 years. This being so, particularly in view of the current national economy, a weapon system could price itself out of existence.

There is no choice but to reduce machining time as much as possible. It has been done on aluminum airframes in order to cut costs and lead time. More

Abstracted from Paper 174, "Precision Forgings, Solution or Delusion?" to be presented at the 26th ASTE Semiannual meeting. Copies of the complete paper are available for purchase from Society Headquarters.

impelling reasons to do so are found on the steel airframes.

Two approaches to the reduction of machining time are obvious: (1) the development of new tools and techniques to improve the machining methods of high-strength materials; and (2) the development of shaped forms to reduce the amount of machining necessary.

Fig. 2. Conventional forging for an aircraft structural part. The walls have draft and sufficient material to permit machining all critical surfaces.

The first approach is being pursued intensely by airframe manufacturers and others concerned with production. The second approach leads into the field of castings, extrusions and forgings.

Achievements which have been accomplished in the production of close-tolerance forgings for gas turbines and jet engines have been remarkable. Compressor blades and turbine buckets are good examples of precision forgings being turned out in large quantities with consequent elimination of costly machining and grinding operations. Now, airframe forgings, *Fig.* 1, are being considered such as actuator arms in control systems, wing-to-fuselage attach fittings, bulkhead frame corners, fittings for land gear, armament, empennage, engine mounts and fuselage attach stations.

What are the differences between a conventional steel forging and a precision steel forging? Primarily, the conventional forging, *Fig.* 2, has draft angles, usually 7 degrees, whereas the precision forging has no-draft walls. The conventional forging has plenty of material on areas to be machined, whereas the precision forging should be within finish dimension tolerances in almost all areas. Only a minimum of stock is removed where finish machining is deemed essential. In the matter of surface finish, the conventional forging is comparatively rough; the precision forging has a 63-microinch surface or, in the extreme, a 125-microinch finish. Comparison with the finish machined part, *Fig.* 3, shows the savings in machining time which can be gained by use of a precision forging.

Airframe engineers try to design for maximum strength with minimum weight. Most parts incorporate, wherever possible, pockets, thin webs and ribs, and other weight-saving features. The machining of such enclosed or inside surfaces has always been expensive in aluminum. In high-strength steels and titanium, the difficulties and costs are compounded.

The ideal precision forging would be one which could emerge from the forge requiring no machining, except for any necessary holes. This ideal has been approached in research and development work. Stainless steel and titanium forgings have been produced with only contact or working surfaces requiring a machining cleanup. Costs have been high, rejection rates have been excessive and difficulties have been numerous. Whether such forgings could be produced on a commercial production basis where the potential savings would warrant production is problematical.

Designs of these experimental parts have been selected to incorporate as many difficult forging procedures as possible. Thin walls, deep pockets or cavities and irregular contours have been studied with a view to determining limitations of the process. Because of cost considerations, parts have been confined to relatively small sizes, ranging in plan area from approximately 25 to 200 sq inches.

Techniques of forging have varied since most knowledge of the forging art is gained through the interpretation of experiences. One forger staunchly believes in the process of hammering with cold dies; another advocates the use of heated dies in a press. Therefore, differences of opinion have

Cost Analysis for Precision Forgings*

Typical Piece Part	Conventional Forging Die Cost ($)	Conventional Forging Piece Price ($)	Precision Forging Die Cost ($)	Precision Forging Piece Price ($)
A	1,450.00	4.46	14,000.00	100.00
B	1,100.00	3.40	14,720.00	40.00
C	1,958.00	3.29	18,500.00	420.00

*Piece prices are based on quantity lots of 200 for conventional and 5 each for precision forgings.

developed relative to the design of tooling, staging of heats and hits in the actual forging procedure.

As is the case in nearly all such disputes, probably no one technique is completely correct or completely wrong. The best features of each will be brought out in continuing developmental work so that an optimum procedure may be derived.

Differences in tooling exist in the basic concept as well as in materials used. For example, one forging company developed tooling consisting of two blockers and a final die with an ejecting mechanism. The materials for the tools were H-1 (chrome-moly-tungsten) hot-work tool steel for the dies and H-3 (chrome-nickel-moly) tool steel for the die holders. Another firm designed a heading die, a blocker and finish dies for the job. The finish dies incorporated heating elements in the holders. Tool steels used were of the H3 class for dies and holders, with some insert details of an H-1 alloy.

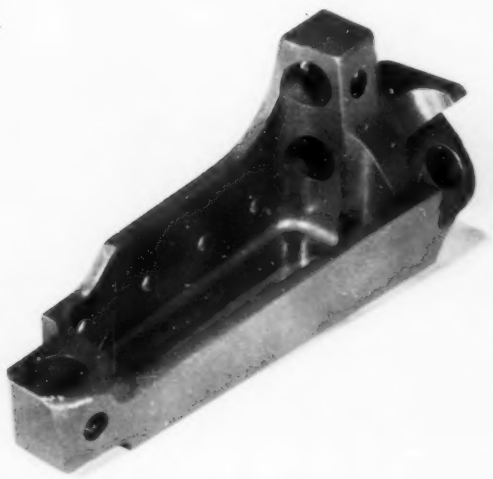

Fig. 3. Finish-machined aircraft forging shown in *Fig.* 2. Excess material has been removed and location surfaces have been finished for hole locations and weight reduction.

In the natural course of development, some tool changes have been made to allow greater metal flow in certain areas to reduce part thickness. In some instances die breakage has occurred, necessitating rework or replacement with a re-evaluation of design for strength characteristics.

Various protective coatings have been used on the different materials during the heating processes. Special coatings or platings have been applied to permit linear movement of the material, in plastic condition, within the dies without detracting from surface finish.

The physical process of forging precision parts can be lengthy and complicated. For example, one titanium forging required fourteen heats in order to form a channel section. Grinding and vapor blasting operations were necessary between some of the forging operations.

In another case, forging at 1750 F was proving difficult because the rapid cooling lowered the material below the minimum for workability. By increasing the heat to 2100 F better metal flow produced improved dimensional accuracy. However, the penalties for so doing were lower ductility and less refined structure.

Remarkable features have been produced in some precision forgings. Web thicknesses have been forged as thin as 0.094 inch; cavity or pocket depth has been as shallow as $1\frac{1}{4}$ inches (with no-draft walls); and curves or contours have been forged to finish dimensions within allowable surface roughness requirements.

It is apparent that precision forgings are relatively expensive compared to conventional forgings. It should be possible, when sufficient information is available, to develop a "rule of thumb" method of estimating the die cost and piece price of a precision forging. At the present time, it is difficult to draw a reliable cost comparison. Precision forgings are in the development stage; consequently, prices are considerably higher than they would be if calculated on a production basis.

An indication of cost ratio can be obtained from a recent study in which three parts were evaluated. Both conventional and precision forgings for the same high-strength material were used. It must be emphasized that the conventional forging prices are based on production runs, while the precision forging prices are based on a development program.

The true value of a precision forging, of course, can be determined only when total costs are compared. The basic price of the forging die, the cost of forging itself and setup charges must be added to the cost of machining, special tooling, processing and handling and all other manufacturing costs. Then, the die and tooling costs should be amortized over the quantity of parts required. Only in this way can the actual cost differential between conventional and precision forgings be assessed.

Compromise seems to be the key to success in producing precision forgings. Dimensional accuracy has been obtained at the expense of other qualities. Conversely, other qualities, such as ductility and fine structure, can be obtained at the expense of accuracy. This same principle of give and take must be applied to other factors in the production of precision forgings.

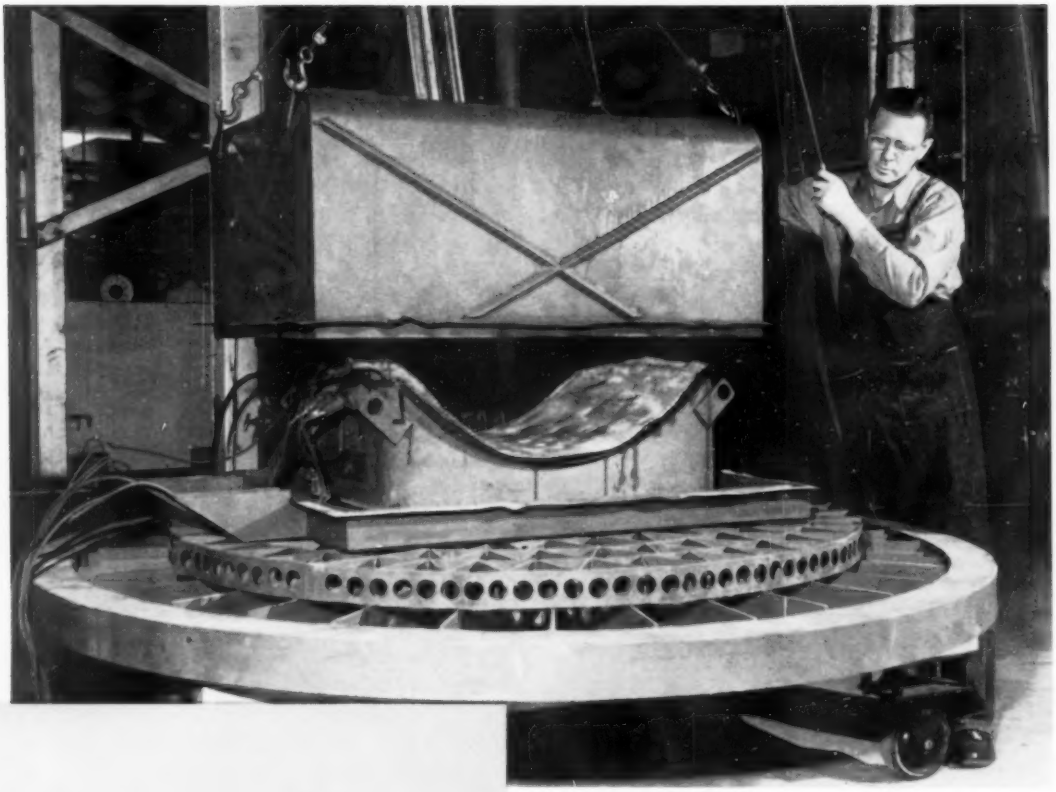

Fig. 1. Vacuum type brazing fixture being placed in retort.

BRAZING HONEYCOMB SANDWICH

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Abstracted from Paper 132, "Honeycomb Sandwich Fixtures at 2000 F," to be presented at the ASTE Semiannual Meeting. Copies of the complete paper will be available for purchase from Society Headquarters.

With the advent of the space age, honeycomb sandwich has come into its own as a valuable construction material. Many new techniques of manufacturing have been developed to produce it economically. Here is how one of the manufacturing problems—brazing the sandwich together—was solved.

HONEYCOMB SANDWICH is finding increasing use as a construction material in aircraft and missile manufacture where light weight and high strength are prime factors. In order to realize the utmost in strength from the structure, efficient bonding of the sandwich core and facing is essential. Brazing the layers together, *Fig.* 1, has proved the most effective means of construction of sandwich made of stainless steel and related alloys, *Fig.* 2. The brazing is accomplished at from 1650 to 2200 F in an inert atmosphere inside a retort.

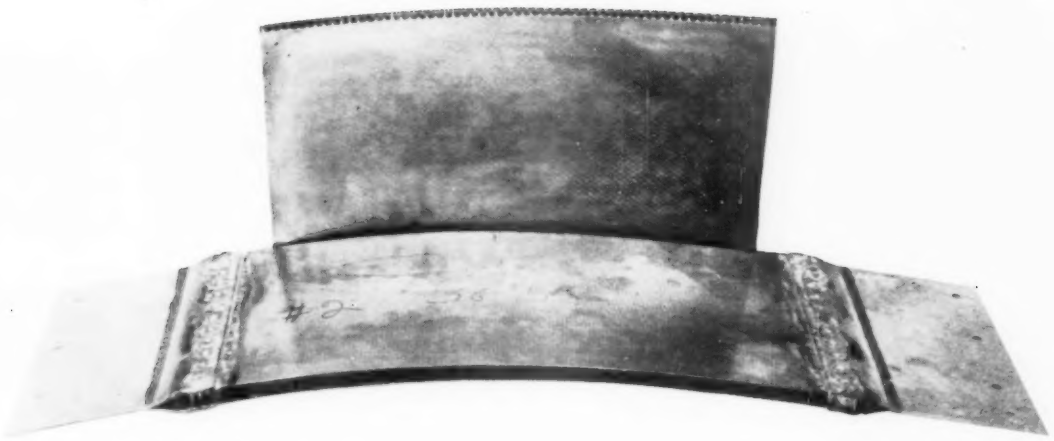


Fig. 2. (above) Stainless-steel honeycomb sandwich used for aircraft construction.

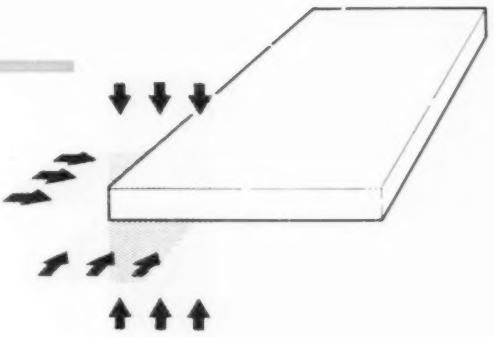


Fig. 3. (right) The corner of a flat plate heated in a furnace heats faster than the center because radiation is absorbed on four surfaces instead of only two.

Construction: Sandwich is composed of core, facings, edge attachments and—in some cases—inserts. The core is constructed by corrugating and welding ribbons of metal. To insure good contact between the facings and core, accurate surfacing of the core is required. Conventional milling and abrasive operations have been used for surfacing with some success. Highspeed rotary knives are used extensively for surfacing stainless steel core.

After surfacing the core, all components are carefully cleaned. The edge members and inserts are tack-welded to a firing fixture; the core is similarly attached; brazing alloy is applied, and the facings fastened into place.

Fixtures: The function of a firing fixture is to hold all brazing surfaces in contact during the brazing cycle. The fixtures must be designed so that they provide uniform heat distribution to the workpieces. The thermal conductivity of the fixture material has a significant effect on the rate and manner in which the sandwich heats. The influence of thermal conductivity is illustrated in *Fig.* 3. A flat plate within uniform radiant-heat surroundings absorbs heat by radiation of four surfaces at the corners, while the center of the plate absorbs on only two. The temperature gradient between the corners and the center depends on the thermal conductivity of the plate material. Normally the conductivity is not high enough in sandwich to reduce the gradient to within safe limits. A better thermal balance can be obtained by adding mass to the fixture and surrounding the sandwich with another material distributed so as to provide nearly uniform heating. This generally is accomplished by adding an equivalent mass opposite the reference plane and larger masses at the ends, *Fig.* 4. The reference plane is the amount of material required for basic construction of the fixture.

Fixtures apply pressure to the sandwich either mechanically or pneumatically. Mechanical fixtures are usually heavier and more complex and have given way in almost all cases to pneumatic types.

Pneumatic fixtures are of two types: vacuum (or partial pressure) and positive pressure. A negative pressure is maintained in a vacuum device causing

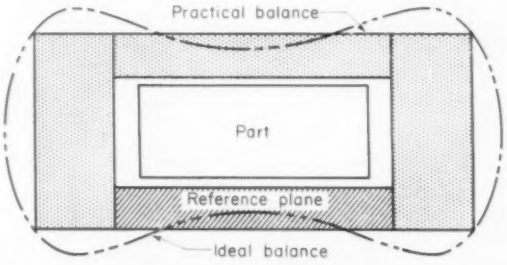
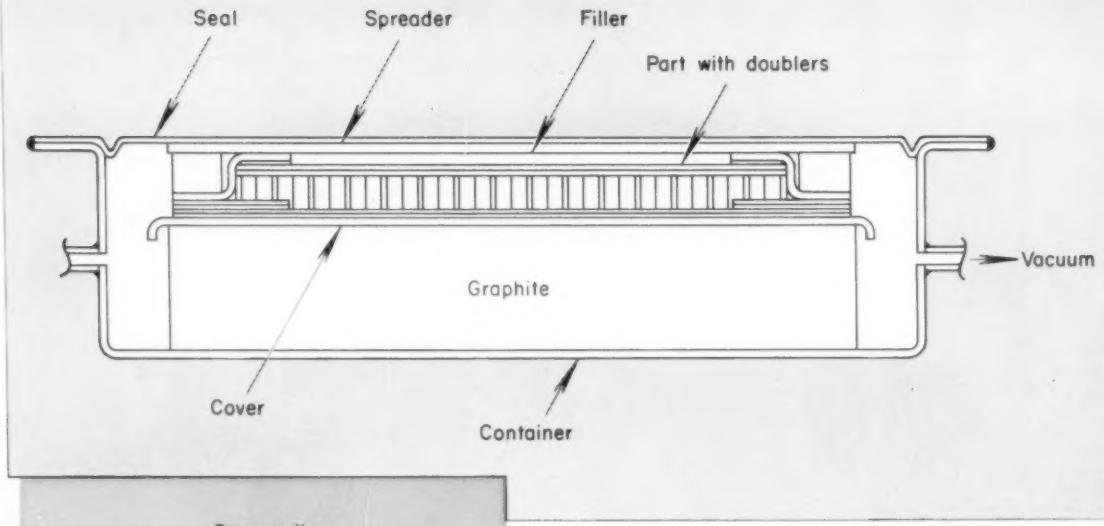


Fig. 4. To provide uniform heating, the part is often surrounded by additional mass in addition to the reference plane.



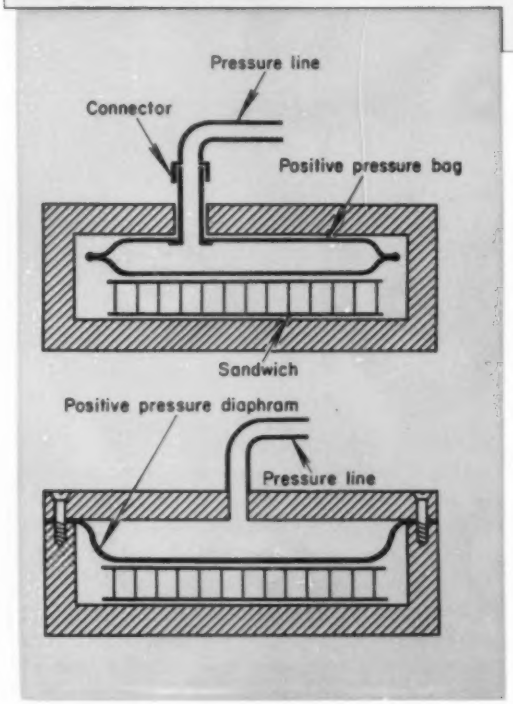


Fig. 5. (above) A thin seal provides contact pressure in a vacuum fixture.

Fig. 6. (left) Types of positive pressure arrangements of pneumatic fixtures.

Fig. 7. (below) Part produced using pneumatic brazing fixtures.

a thin seal, *Fig.* 5, to hold the sandwich against the reference plane.

Positive pressure fixtures, *Fig.* 6, utilize either a bag or a diaphragm to apply pressure. This design is preferred since leakage does not present serious problems if pressurization is done with inert gas.

An example of parts produced with pneumatic fixturing is shown in *Fig.* 7. The part is a Haynes Alloy No. 25 engine component. It consists of six segments of honeycomb sandwich and six box channels, brazed separately as subassemblies. The sandwich pieces are made with vacuum fixtures and the box channels held together mechanically during brazing. The subassemblies are then brazed in a pressure type fixture to complete the assembly.

Retort Design: A retort provides an enclosure for a protective atmosphere of high quality around a honeycomb sandwich fixture. The atmosphere protects the fixture and its contents from oxidation, particularly when leaks develop in a vacuum system. While the retort often protects the sandwich directly in pressure brazing systems, leakage of the pressure bag is not serious since the likelihood of air entering the fixture is actually diminished.

Lightweight retorts are most desirable from an over-all economy standpoint. Heating rates are faster, repair and maintenance are facilitated by lighter materials and lighter handling equipment can be used. These advantages are offset somewhat by a tendency for greater part distortion and shorter retort life.

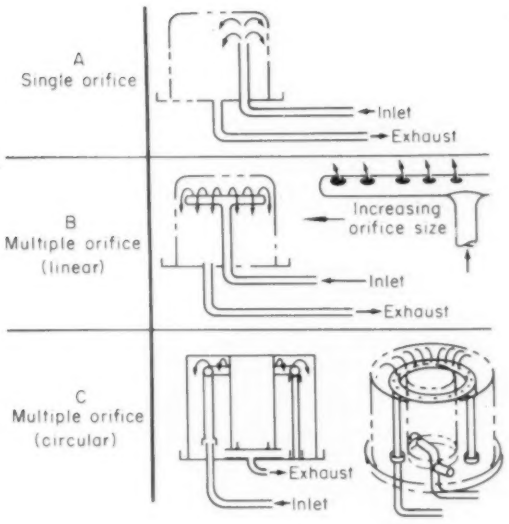


Fig. 8. (above) Methods of distributing protective gas atmosphere in retort. These are for gases lighter than air. Heavier gases are introduced at the bottom and drawn out the top.

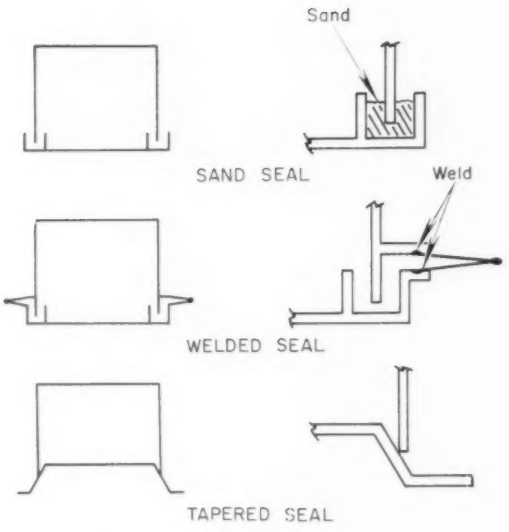


Fig. 9. (upper right) Various retort seals. The tapered mechanical seal has proved most satisfactory.

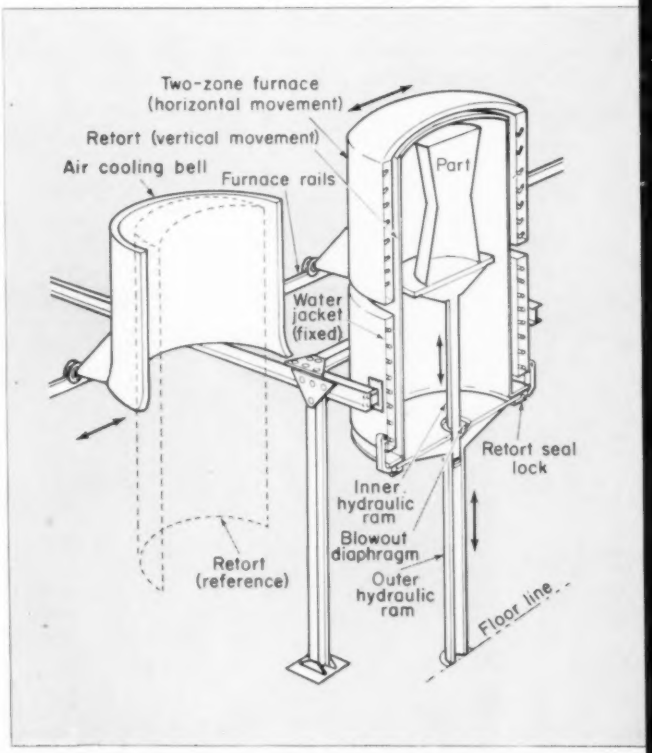


Fig. 10. (right) Integrated system for brazing. Retorts are raised into furnace and cooling bell hydraulically. Part may also be moved within retort.

Retort materials may be substantially downgraded and still exhibit long life by the use of ceramic or metallic coatings. Aluminized coating is preferred since, in addition to providing oxidation resistance, the surface conductivity distributes heat evenly, minimizing part distortion.

Two conditions are necessary for optimum retort operation: the gas must have controlled direction, and distribution must be uniform. Gas is introduced into the retort by means of an open line or drilled manifolds, *Fig.* 8. Direction is determined by location of inlet and exhaust orifices. Distribution of the gas is controlled by providing a multiplicity of orifices, and diffusion is controlled by impingement against the top of the retort.

Various seals are used to control exhaust gas, *Fig.* 9. Sealing with sand is simple, fast, and economical. The difficulties which arise from distortion caused by the insulating properties of the sand, the ease with which the sand may become contaminated, and the possibility of blowing out a portion of the sand seriously offset its advantages. A welded seal in the same figure is considerably more positive, but takes more time to make. A mechanical closure on a cone has proved to be practical.

In one installation, *Fig.* 10, furnace and cooling systems are integrated into a single unit. Horizontally moving furnaces and air cooling bells service multiple retort stations. Retorts may be moved vertically within a water jacket, and parts within the retort may be independently elevated.

Although the brazing method described gives satisfactory results, tools and fixtures can be effectively improved. These tooling improvements will make honeycomb sandwich competitive with conventional materials in many new fields.

Gadgets

Ingenious Devices And Ideas To Help The Tool Engineer In His Daily Work

Plugging Pressure Pin Holes

When running a piercing die in a large press that has a series of pressure pin holes in the bolster, the slugs may fall through the holes onto the air cushion. This can be a source of trouble unless the holes are plugged.

The plugs illustrated have a chamfer on one end that fits the chamfer on the pin hole. Heads of the pins are machined so that they are slightly below the top surface of the bolster when installed.

Since the plugs are cold-rolled steel, they can be magnetized by being placed on a magnetic chuck. The magnetized plugs are securely retained in the holes, yet are quickly removed when they are not needed. A sheet metal tray, fastened to the press, is a convenient place to store the plugs when not in use.

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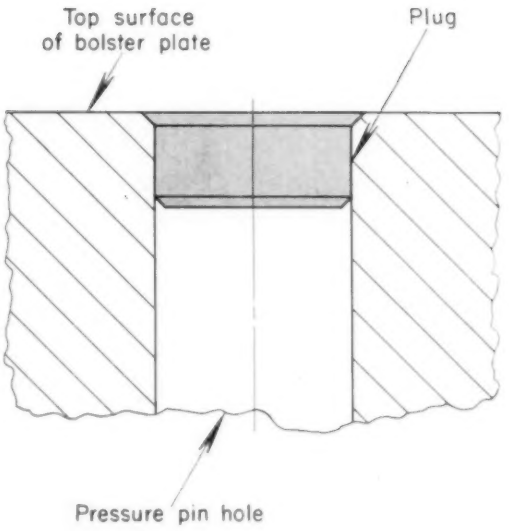

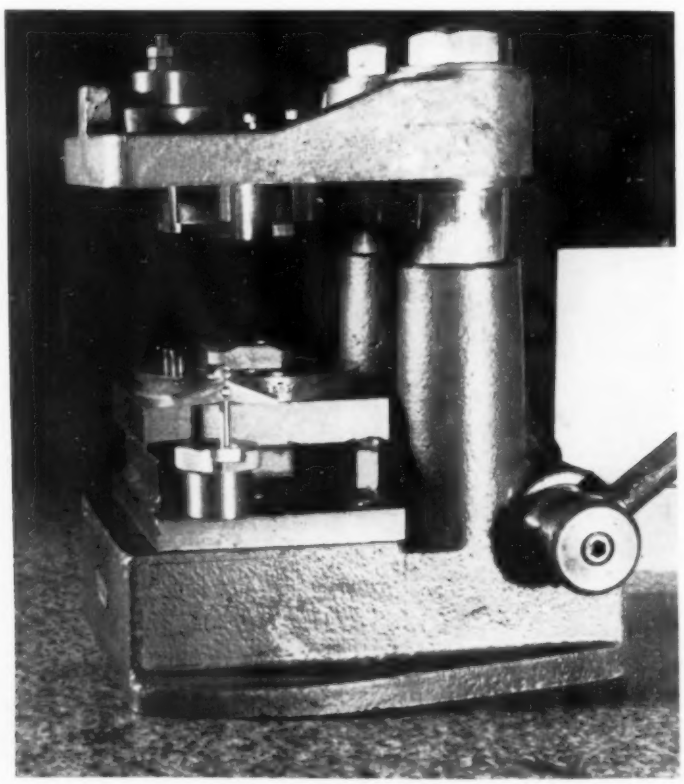

Drill Bushing Storage

Drill bushings are frequently misplaced or separated from the drilling fixture. Loss of time while hunting for misplaced bushings or making new ones can be avoided by drilling and tapping holes in the fixture to accommodate standard toggle bolts as shown. The wings of the bolts are pressed together to remove the bushings; at other times the bushings are held securely in place. A nut is used to lock the toggle bolt to the fixture.

Ernest Egger
Louis Joliet Chapter

Layout Tool

Angle plates and height gages are used in layout work when high accuracy is required. With less stringent accuracy requirements, a combination square and scriber can be used. There are, however, many layout jobs that have accuracy requirements between these two extremes. The layout tool illustrated can be set rapidly, yet provides a higher degree of accuracy than is obtainable with a combination square and scriber.

As shown, the tool consists of a threaded rod, collars to hold the scriber and a knurled disk that can be moved along the length of the rod. The scriber pin fits into an oversize hole in the end of the rod between two notched unthreaded collars. Two threaded locking collars are tightened against the notched collars for final positioning and locking of the scriber.

A shoulder collar on the knurled disk is the same diameter as the threaded collars so that the tool is kept level during the scribing operation. The knurled disk is kept from rotating freely by a spring-loaded nylon locking plug that is retained by a setscrew. A shoulder pin projects from the opposite side of the disk. By pushing this pin, the locking plug is released and the disk can be rotated rapidly for quick adjustment.

There are ten threads per inch on the rod; thus each turn of the disk moves it 0.100 inch. Coarse adjustments are made by using a scale on the rod. A scale on the rear of the disk is used in making fine adjustments. Each main graduation on the scale represents 0.010 inch travel. The gage can be adjusted to 0.002 inch by estimating the distance between lines on the scale.

Before the tool is placed in service, the actual distance between the scriber and the knurled disk is measured and the scriber is precisely positioned by turning the two locking collars.

Clint McLaughlin
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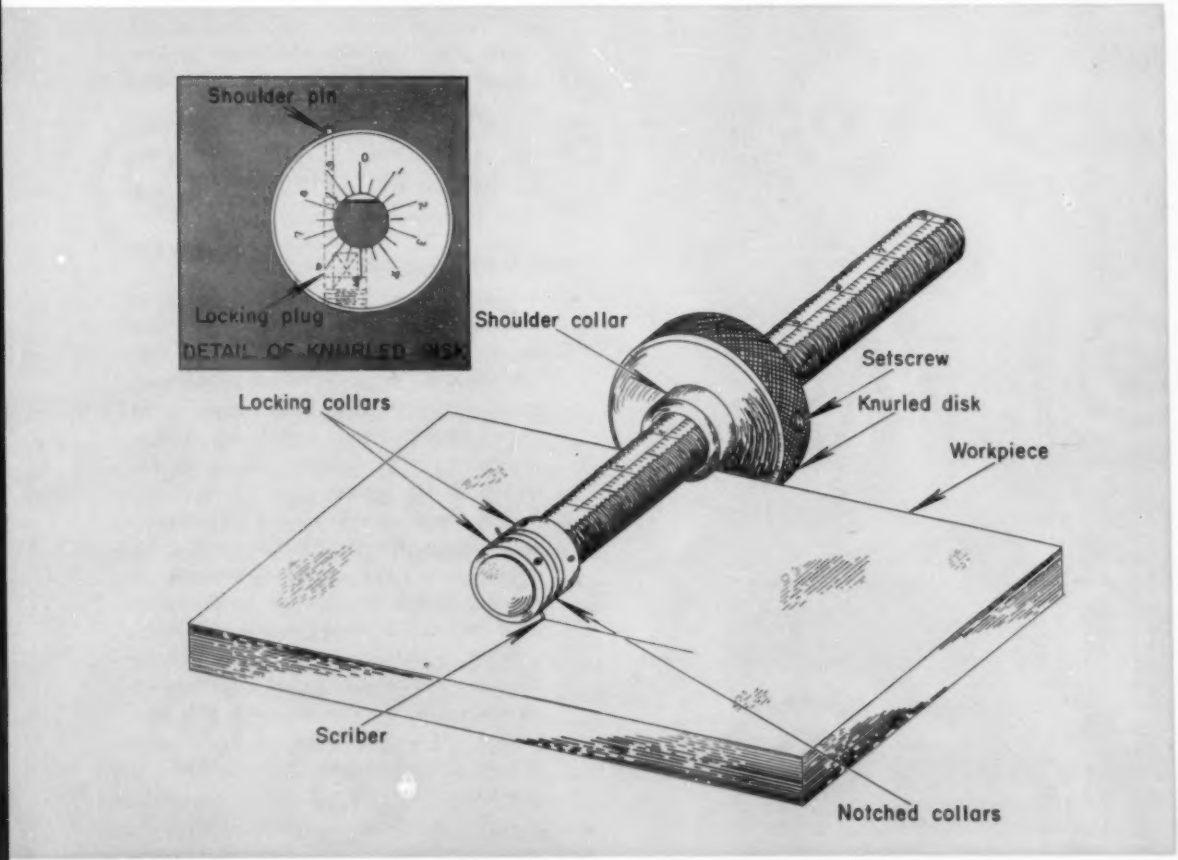

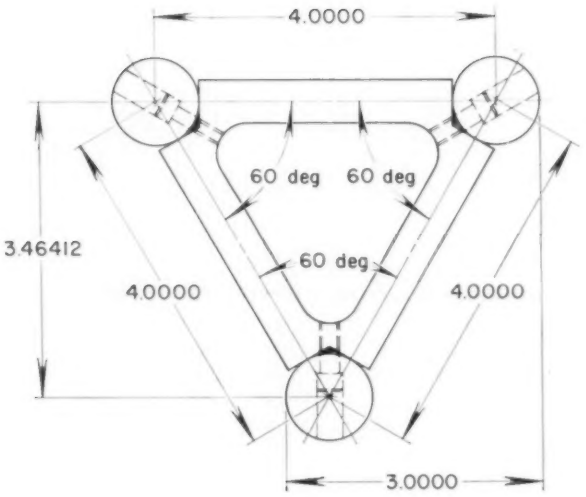

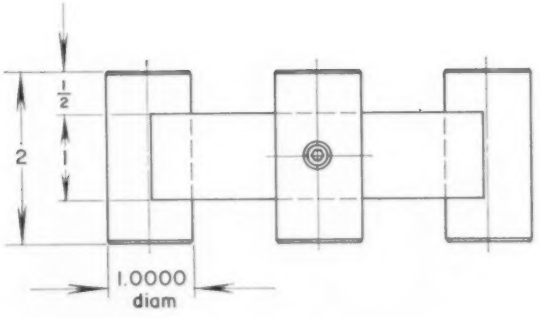

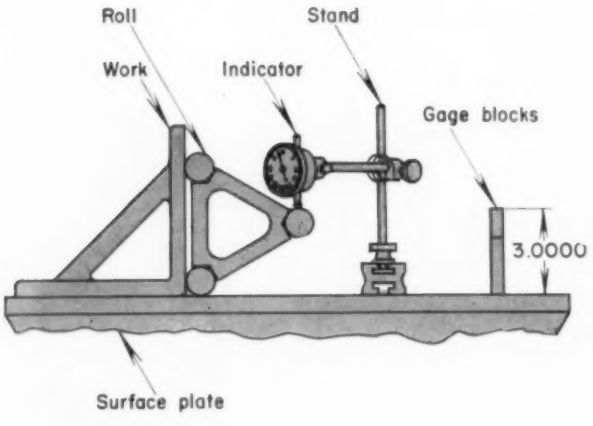

Tri-Sine Bar

Either expensive instruments or a long process of calculation are normally required when checking the squareness of an angle plate or similar workpiece. Using an indicator and inverting the work are feasible only when the part has either four square sides or two sides which are parallel.

The shop-made instrument shown in the accompanying illustration is a valuable asset to any toolmaker faced with this problem. Its precision will depend on the care taken in its construction, although it is no harder to make than a fine die, jig, or fixture. The rolls are tool steel, hardened and tempered, and the center block is cold-rolled steel. The rolls and blocks are machined and ground to size, then assembled with cap screws.

A standard surface gage is used as an indicator holder. Setting the work on a flat surface plate with the tri-sine bar in position, the indicator is "zeroed out" on gage blocks to exactly 3 inches. The indicator is then transferred to the top of the outer roll of the bar. The variation reading of the indicator is divided by 4 and then multiplied by the length of the work. This will show the actual deviation of the work surface from 90 deg. This process is repeated after truing up until a zero reading is obtained on the indicator. The work will then be exactly square.

The dimensions shown are for an average size bar. They may be increased or decreased to suit individual requirements. A parallel should be clamped to the work when its length is shorter than the bar itself.

When a quick check is required, a micrometer or vernier height gage may be substituted for the dial indicator and gage blocks. The difference from 3 inches must also be divided and multiplied to find the variation in its length.

Detlef Schilling
Toronto, Ontario

determining MACHINE LOADING for the job shop

By John E. Epprecht
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Caldwell, N. J.

Control of machine loading is an important tool of management for making the most efficient use of man-power and machines. The author discusses how his company uses its punched card system for this purpose.

CALCULATION OF MACHINE LOADS versus machine capacity varies with the particular industry, size of the operation and the control requirements. In many plants, a separate department is established to maintain the records for the determination of shop capacity, machine loading and machine requirements. Usually, these records are kept on the basis of either the existing schedule or the predicted schedule or both.

The old system at Wright Aeronautical was not different from many others requiring tedious hand-posting operations. Vast quantities of records were accumulated and maintained in cross-indexed binders. Even with the minute details, "crash" totaling programs were required to condense and supply information on manpower, capacity and loading for management.

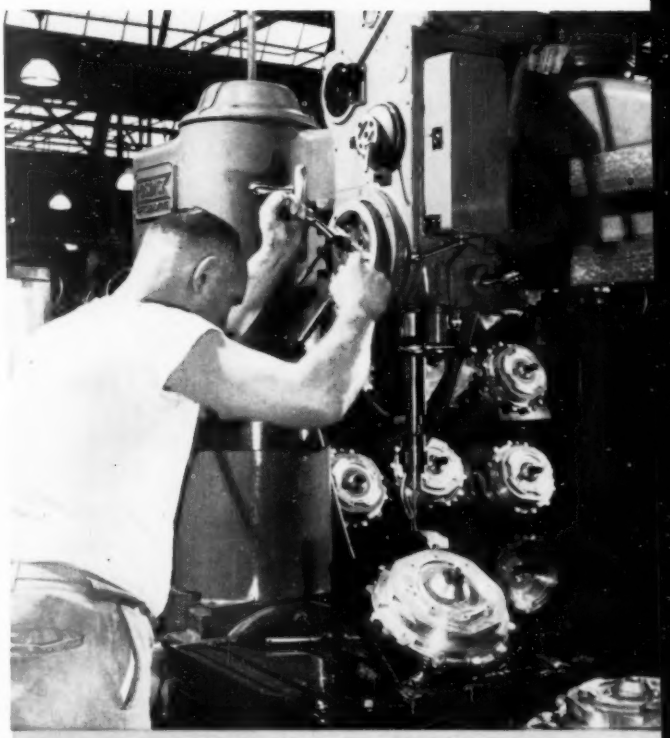


Fig. 1. Drilling, reaming and tapping are typical of the operations performed in aircraft manufacture. A tilting table fixture is used on a radial drill in batch-lot production.

Machine Code Chart

Machine	Code No.	Location	Quantity	Available Hours	Load
Drill press, Allen, 2SP, 23 in.	0102202	G. M. S.	1	320	x
Miller, Cinn., horiz, 2-plain	0322317	Alum. line	2	640	x
Turret lathe, Bullard, vert. 36 in.	0432136	Hub line	6	1920	x

Fig. 2. An example of the master machine code chart used by the process engineer when writing the operation sheets on a production part. The code numbers identify the machine being used on each particular operation.

These methods were far from foolproof and the results were the basis of many arguments between shop production and planning personnel. As part of a cost-reduction program, a careful study of the entire operation was made. Various changes in the existing system and other possible commercial systems were analyzed. Goal of the study was to find a way of supplying the desired information when required without the need of a large number of indirect expense personnel.

Although most of the systems studied proved able to partially supply the required information, they all needed additional technical and clerical personnel to keep the information current. Operation of any system was further complicated by the short production runs per setup. As many as 500 different precision parts, *Fig.* 1, were being processed through the shop over a three-month period. The average number of machining operations was twenty per part or about 10,000 operations over this schedule period.

Time standards were available for the operations

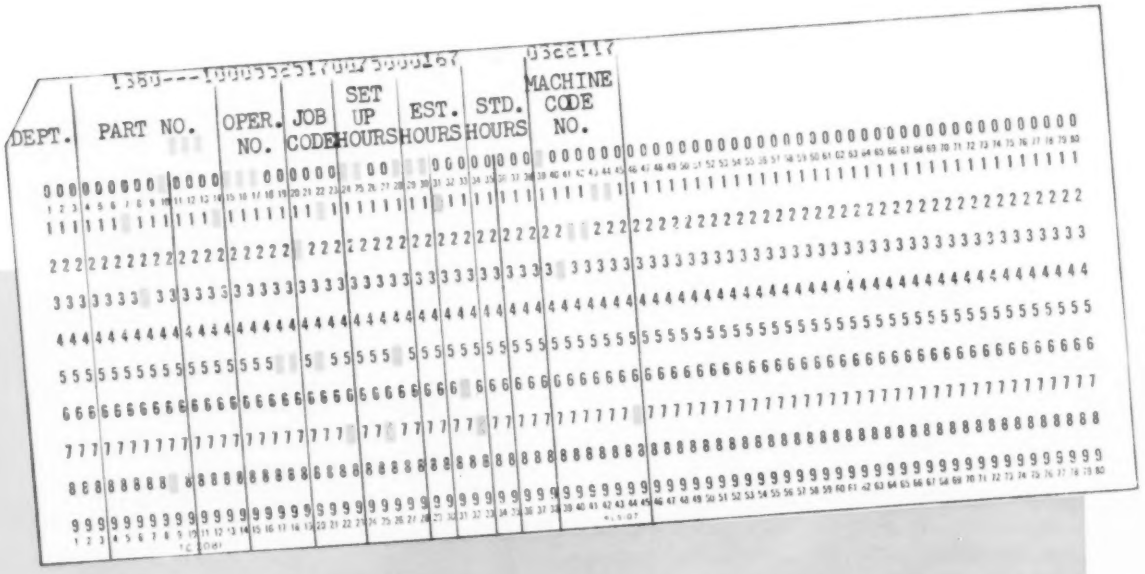


Fig. 3. Typical example of the punched card for a production part. Standard hours to perform the operation are included, as well as the operation number, part number and machine code number used to produce the part.

so a code could be devised relating the operation to the equipment required for the particular operation. With this information available, a punched card system could be used to supply information, such as the time standards of parts by operation in manhours plus the setup time in manhours. A condensed master code chart was devised, listing the quantity and type of machines available, as shown on the sample sheet in *Fig.* 2.

The standard 7-digit code was established by the standards department for the punched cards which would be maintained by the accounting department on existing equipment. Two digits were used for the type of machine, two digits for the manufacturing model, one digit for the class of machine, such as horizontal or vertical and two digits for the manufacturer name. This code simplified identification of a particular operation by all personnel concerned.

Operation of the system can be based on any period for which information is required, such as weekly, monthly or yearly. Establishment of the planning schedule is done by checking the existing production schedule for the quantity of parts required. By multiplying the number of machines available by the hours available, the period capacity is calculated.

For a month period, a constant of 320 hours per month per machine would be available if each machine were running at 100 percent efficiency. This figure is obtained by using an 8-hour working day multiplied by 20 working days by two shifts. Since no operation is 100 percent efficient, standard variance percentages prevailing in the shop are used to determine the actual load, such as 80 percent efficiency on a machine makes 256 hours available each month.

The degree of accuracy required and the schedule period determine the approach. If the capacity for each individual machine is needed, each machine must be coded individually. If the capacity for types of machines is required, the same types of machines like internal grinders or lathes can be grouped in a common category. This grouping can supply to the machines of the same manufacturer, as shown in *Fig.* 2, or for machines of the same type but by different manufacturers if they do the same jobs according to the same time standards.

With any system, practical experience in the particular shop is a prime requisite to efficient operation. Knowledge of machine down-time percentages, operator efficiency, absenteeism rate, tool waiting time, gages, materials, and other such data are necessary to determine variances.

When preparing a job for the accounting machine, the operation sheets are coded with reference to the machine assigned to the particular operations. Responsibility for maintenance of the operation

MACHINE CODE NUMBER	PART NUMBER	OPERATION NUMBER	LOAD HOURS
0102202	145995	180	10.28
0102202	146084	120	2.60
0102202	146212	380	.75
0102202	148732	100	5.70
0102202	149569	80	24.89
0102202	149725	95	6.03
0102202	150559	50	2.75
0102202	150668	260	1.25
0102202	152663	120	1.08
0102202	153142	150	10.89
0102202	154110	100	2.02
0102202	154600	140	14.37
0102202	154844	150	6.85
0102202	115692---1	110	22.56
			191.25*
0102206	148343	100	201.40
0102206	148343	110	32.51
0102206	155018	130	29.49
0102206	155018	140	3.99
			267.39*
0102302	143410	140	4.07
0102302	143411	270	3.82
0102302	146197	100	7.32
0102302	146223	60	1.95
0102302	146492	160	9.50
0102302	147633	170	3.40
0102302	148727	115	2.00

Fig. 4. Load hour report published by the accounting department showing the total number of hours on a particular machine. Also included is the number of hours for each part.

sheets is assigned to the process engineer who established the original methods on the part. Any changes in the original machine assignment, such as the use of a different machine for the operation, require a change in the code number on the operation sheet and the cards (*Fig.* 3 is an example) by the engineer. Any system is only as good as it is maintained and, therefore, operation sheets must be kept up to date for effectiveness. This is the only actual labor requirement of the system replacing the attempts to keep daily records, changing and posting paperwork constantly.

When management wants to establish the load for any machine or machines for a particular period, knowing the number of parts to be processed, the procedure is simple. First, the quantity of parts is multiplied by the standard times for the operations required. Second, the number of setups required per part is determined and is multiplied by the standard setup time. Finally, these two products are added and adjusted with the established variance for the total load. These figures can be compared with the known capacity to obtain the desired information. An example of the load hour report may be seen in *Fig.* 4.

It is not advocated that established systems of shop scheduling or machine planning be eliminated. All have their places, depending upon the magnitude of the operations and the management requirements. If the present systems are maintained adequately and accurately, the cost of indirect labor can be substantiated.

It is recommended that this type of system be used for shops that cannot afford the luxury of individual departments for daily machine loading. The system can be maintained by the process planning or shop personnel who are available for other related work. Only a few minutes are required for code number changes at the time an operation change is recorded on the process sheets. No extra personnel is needed and, when a report is requested by management, only one man working eight hours is needed to accumulate the totals for a given period.

While the system was originally designed to point out exceptional cases of bottlenecks in production, other uses have been found for similar systems. It has been applied on a daily basis where the expense justified the installation. Toolrooms and experimental departments, *Figs.* 5 and 6, find it applicable when planning is required.

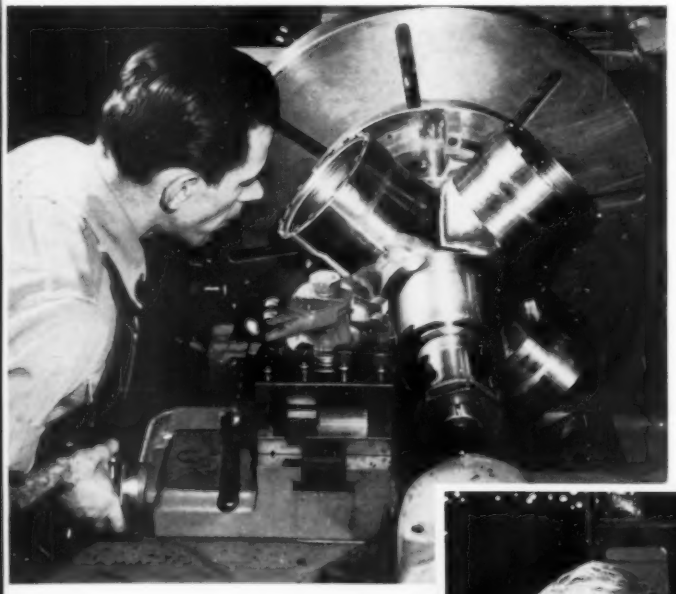


Fig. 5. Blending the outside diameter, angle and radii on a propeller hub using a tracer lathe. This operation is typical of experimental production.

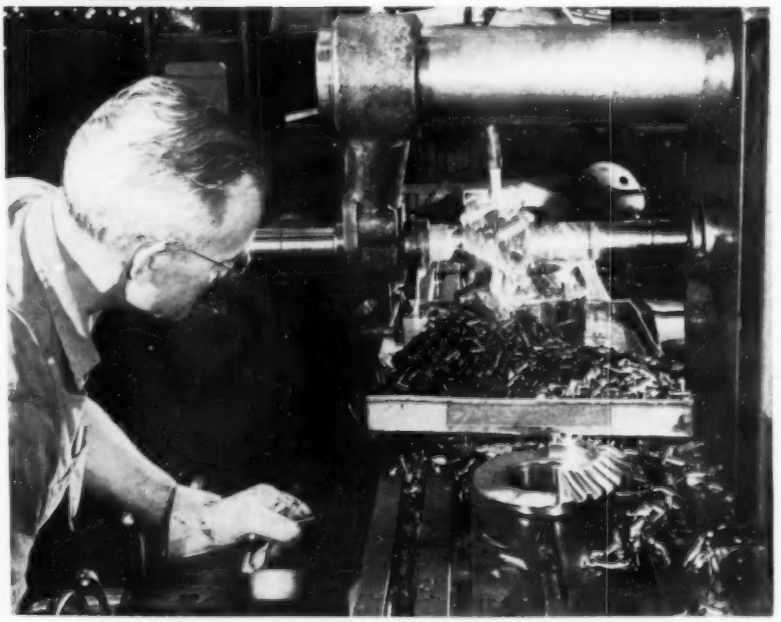


Fig. 6. (right) Milling a segment of a gear to a depth of 1.250 inches.

PLATING without electricity

...improves corrosion resistance

INCREASED UNDERSTANDING of the conditions favoring "electroless plating" has resulted from recent research by the National Bureau of Standards. This chemical deposition process for plating nickel and cobalt on metal surfaces is similar in many respects to electroplating but does not employ electricity.

Unlike electrodeposition, electroless plating can be used to build up smooth, uniform coatings to a definite thickness over irregularly shaped objects without producing nodular deposits on edges and corners. In other chemical processes, the depositing metal is randomly distributed over the container walls as well as over the objects immersed in the solution. Also, after several minutes the reaction runs to an end and the exhausted solution must be discarded.

With the electroless process, however, a nickel coating is deposited only on certain catalytic metals, such as iron, nickel, cobalt and palladium; deposition does not occur elsewhere in the bath. Further, by periodically replenishing the bath with appropriate chemicals, the system can be run continuously for hours or even days.

Since the reaction is autocatalytic, that is the nickel itself catalyzes the process, the deposition continues once a nickel surface is obtained on any object. Noncatalytic metals can be made catalytic by immersion in a dilute solution of palladium chloride, which coats the metal surface with an almost invisible film of catalytic palladium.

Electroless nickel deposits are not pure nickel but consist of a special nickel-phosphorous alloy containing about 8 percent phosphorous. The deposits are bright and much harder than pure nickel deposits. Electroless plating involves the reduction of hot nickel salt solutions (chloride or sulfate) with pure sodium hypophosphite. An organic acid (glycolic or citric acid) is added to the bath as a combined buffering and complexing agent.

To obtain further information on the variables that affect the rate of plating, numerous experiments have been carried out at the Bureau. It was discovered that an increase in the acidity of the bath substantially reduces the rate of plating. For example, a decrease in the pH of the bath from 5 to 4 halves the deposition rate. The most satisfactory pH for the acid bath is between 4 and 4.5.

The organic acids used for buffering and complexing in the baths have specific effects on the rate of deposition. Glycolic acid yields a higher rate of deposition than most of the other acids, with the exception of lactic acid. However, the lactic acid bath is not as stable and produces rougher deposits.

Several hypotheses have been suggested to explain the electroless plating mechanism. The suggested theory involves a two-step process. In the first step, hypophosphite is catalytically decomposed to release hydrogen. In the second step, energy liberated in the discharge of hydrogen is transferred to the nickel ion, and activates the latter so that it can react with the hypophosphite ion. The nature and rate of hydrogen release determine the rate and efficiency of the nickel deposition.

Certain substances such as thiourea and potassium thiocyanate markedly increase the deposition rate. As with organic acids, the effect of these substances reaches maximum at a certain concentration. It has not yet been determined whether these additives can be used in practical plating operations.

Outdoor exposure tests were made of plated steels to compare the protective value of electroless nickel deposits with that of electrodeposited nickel and nickel-phosphorous alloys. Samples were prepared from both acid and alkaline types of electroless baths. Results showed that electroless nickel coatings from acid baths offer greater protection from rusting than electrodeposited coatings.

Although somewhat tarnished, electroless-plated samples had only a few rust spots at the end of a 15-month exposure period. Samples with electrolytically deposited plating of the same thickness rusted considerably during exposure under the same conditions for the same length of time. The protective value of the electroless nickel deposits is equivalent to that of electrodeposited phosphorous alloys which contain about 9 percent phosphorous.

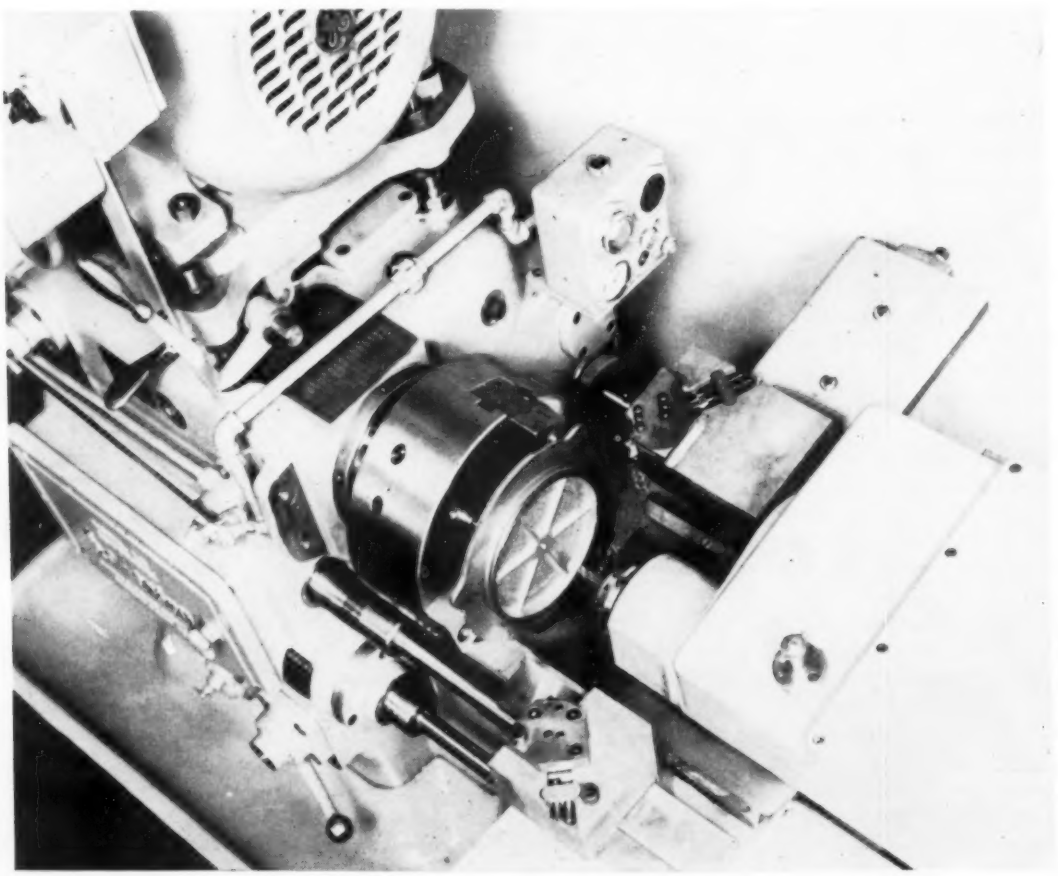
designed for

PRODUCTION

Drilling and Turning Combined on Automatic Lathe

By combining turning and drilling operations on an automatic lathe, machining time and costs were reduced in producing drive clutch plates. The special tooling, designed by Seneca Falls Machine Co., includes a self-contained drill unit to replace the tailstock, and carriages fitted on the front and rear of the machine.

Two carbide-tipped tools on the front carriage are used for turning the two diameters. Facing and chamfering operations are performed by three tools on the rear carriage. Simultaneously, the small bore is drilled and reamed by the drill unit. This motorized drill unit provides the correct drilling speed for the drill and reamer, while the main headstock furnishes the correct cutting speed for machining the large diameters.

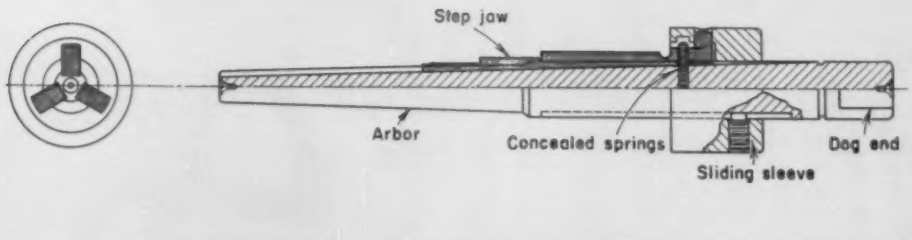


Precision Expanding Mandrels

Mandrels are useful for many operations where the location of the area being machined is related to a hole in the workpiece. Each operation where the hole diameter is different requires a different mandrel. To eliminate the need for an excessive number of similar tools, a mandrel with adjustable jaws can be used to obtain a greater bore and bearing range. One such mandrel, developed by the Le-Count Tool works, maintains concentricity of the jaw faces within 0.0005-inch TIR.

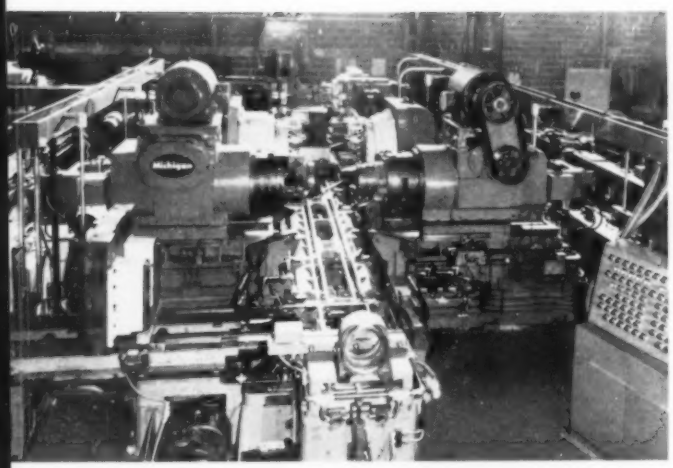
Principal components of this mandrel are the three sliding jaws, the retaining springs, the tapered arbor and the sliding locking sleeve. When the workpiece is located on the jaws, the sleeve and parallel jaws slide up inclined planes on the arbor until the part is firmly retained. Then, the sleeve is locked by the setscrew to retain the jaws and part during the machining operation.

PARALLEL SLIDING JAW MANDREL being inspected with a checking ring having a concentric ID and OD. Mandrel jaws were found to be concentric within 0.0002-inch TIR.



CROSS-SECTION VIEW of the sliding step-jaw mandrel.

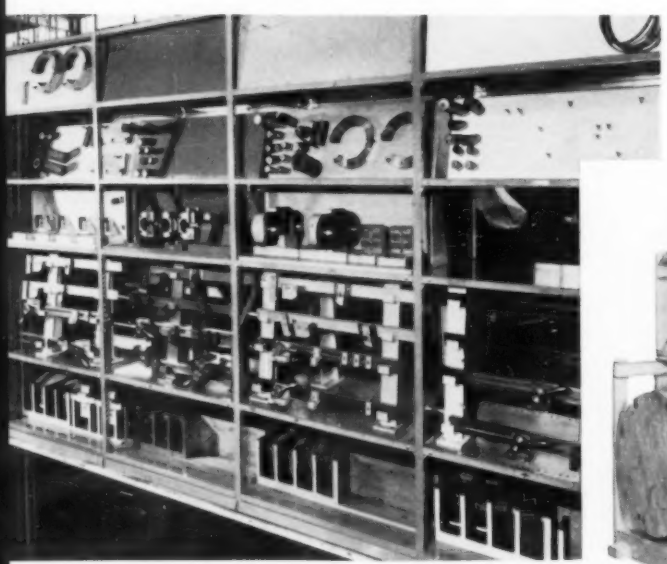
Color-Coding Facilitates Setup



LOADING STATION of the pallet type transfer machine for gear reducer housings. A typical workpiece is shown in the foreground on the end of the machine.

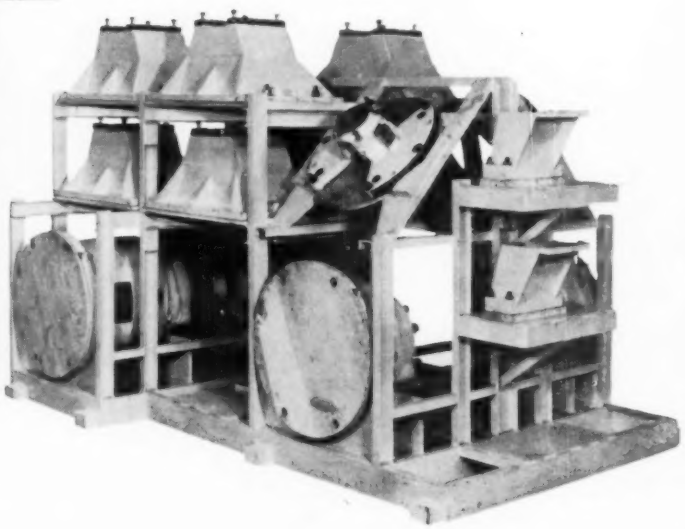
Transfer machines have been considered single-purpose units limited to operations on a single part or parts of a similar size. This concept, however, has been extended by a machine, developed and built by Michigan Drill Head Co., to process seven different sizes of gear reducer housings. Parts range in weight from 85 to 800 pounds with bore diameters from 8.750 to 24.7505 inches.

To convert this machine for a different part, interchangeable drilling and boring heads are used for each housing size, as well as special pallet fixtures for each. This tooling is kept in storage racks and on tool boards adjacent to the machine. Each storage rack, set of heads, group of machine details and tool board for a particular part is color-coded in one of seven colors. At a glance, a check can be made to assure that the correct details have been placed on the machine for the part being machined.



TYPICAL STORAGE RACK for small parts with color-coded feed unit details. Similar storage units are also used for the larger details.

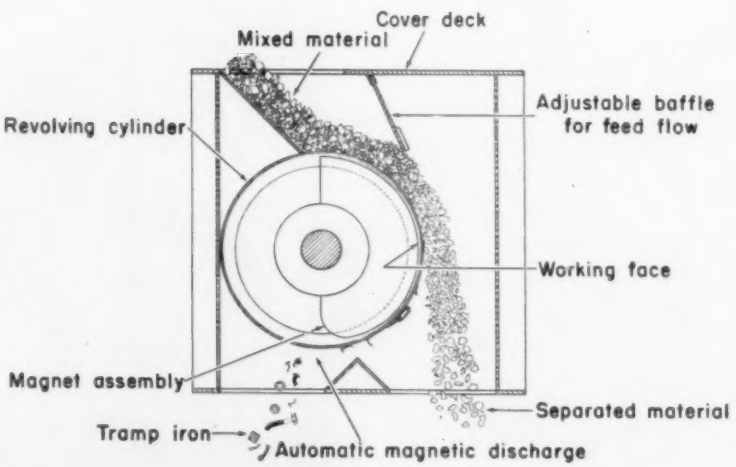
ONE OF THE SEVEN RACKS used for storage of the boring heads and pallet fixtures. All components and the rack are painted the same color for easy identification.



Separator Uses Ceramic Magnets

In a drum separator, designed by Stearns Magnetic Products, a permanent magnet made of ceramic material removes tramp iron from granular material. The magnet is manufactured from oriented barium ferrite. It is lightweight, has high electrical resistivity, has good resistance to demagnetization, and is made of inexpensive materials.

Operation of the separator unit is simple. Mixed materials travel over the revolving stainless steel drum. As the materials move past the permanent magnet, tramp iron adheres to the drum. Clean material falls into one collector chute and the magnetic tramp iron is shunted into another collector when the drum rotates it beyond the magnetic field. Design of the system and its components are shown in the illustrations.



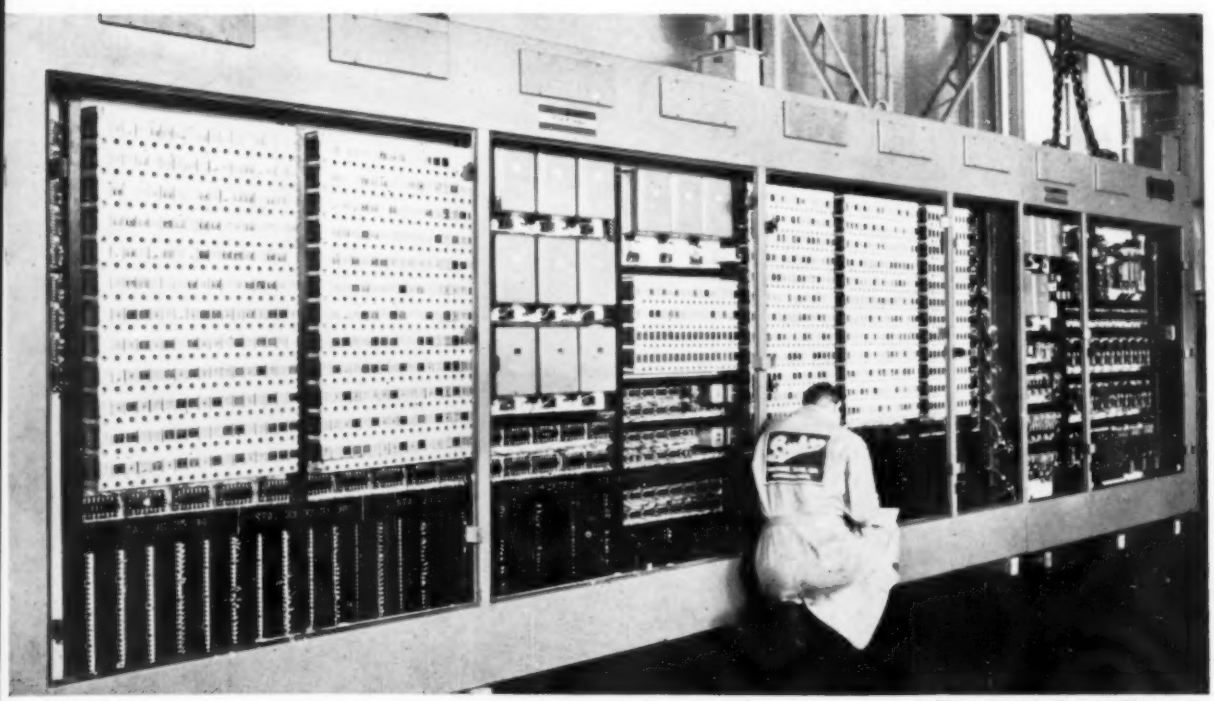
SCHEMATIC DIAGRAM of the magnet separator during operation. The simple operation of the unit without requiring power for the magnetic circuit permits use in any part of a plant.

Static-Control Panel Regulates Machine Functions

Because the life of a static-control device is independent of the number of operations it performs, control panels made up of these units are well suited for mass-production machines. As an example, all electrical functions for a 36-station in-line transfer machine, developed by Buhr Machine Tool Co. are handled through a static control panel.

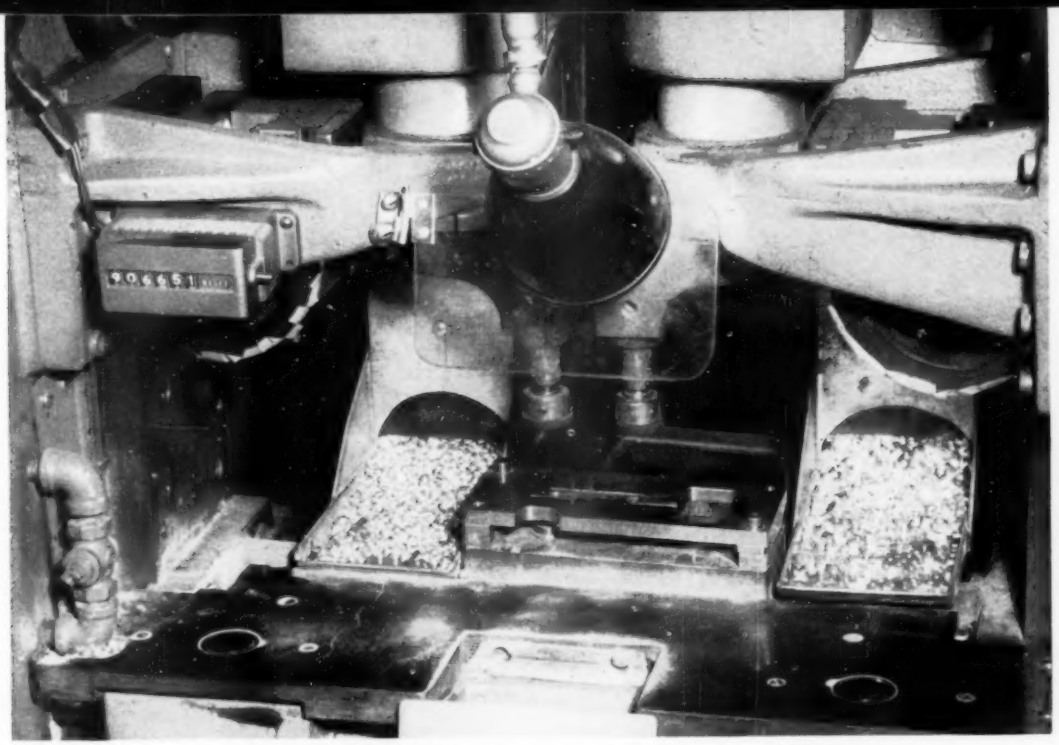
Static-control elements perform the same functions that relays do in conventional systems. Relays convert a single input into various outputs by means of a moving armature, closing or opening contacts. Static-control elements convert inputs into outputs by controlling the impedance of an output coil on a magnetic core.

These circuits generally use four types of logic elements—*and* (two or four inputs) *not*, *or* and *memory*—and time delay units. All inputs must be present to cause an output from an *and* unit. Any of the three inputs in an *or* element will cause an output. With a *not* unit, an input prevents an output, and vice versa. A momentary input to a *memory* unit will cause an output to continue until a momentary input from a second source causes the output to cease. With *time delay* elements, an input will cause an output after a present time lapse. This output will continue until the input is removed. Complex circuits can be built using these basic components as the building blocks.



—Photo courtesy General Electric Co.

STATIC-CONTROL ELEMENTS make up this panel for a 36-station transfer machine. Typical operations controlled through this panel include: walking beam advance, head feed, part positioning, gaging, probing and automatic part unloading. Because of the subassembly construction of the panel, original assembly and subsequent maintenance are simplified. Any unit can be removed and replaced individually or in groups.



Two single-electrode welders used for an assembly operation requiring two hot upset joints on the workpiece. Machines are joined by a single worktable.

HOT UPSETTING produces stronger joints

By D. C. Wherren
Tool Planner
Meter Dept.
General Electric Co.
Somersworth, N. H.

Using standard resistance welding equipment for hot upsetting and swaging, General Electric is obtaining better assemblies with less distortion. This technique has reduced over-all piece costs through more production and reduced scrap.

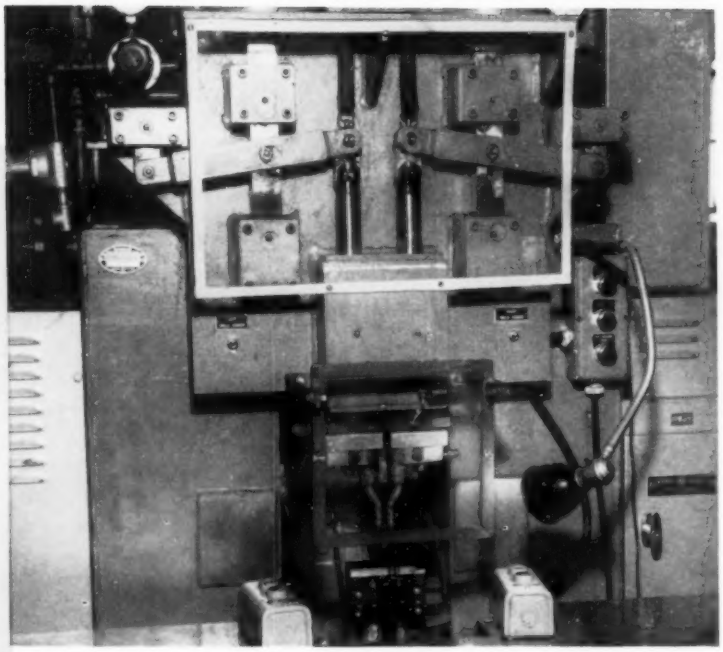
STAKING IS A STANDARD PROCESS for joining parts, using either mechanical or hydraulic force. Another method, hot upsetting, is finding application where excessive force may cause distortion.

In this process, a resistance welder takes the place of the usual mechanical or hydraulic press. During the operation, the portion of the workpiece being used as the stake, is heated to a plastic state by the welder to reduce the amount of force required to perform the operation.

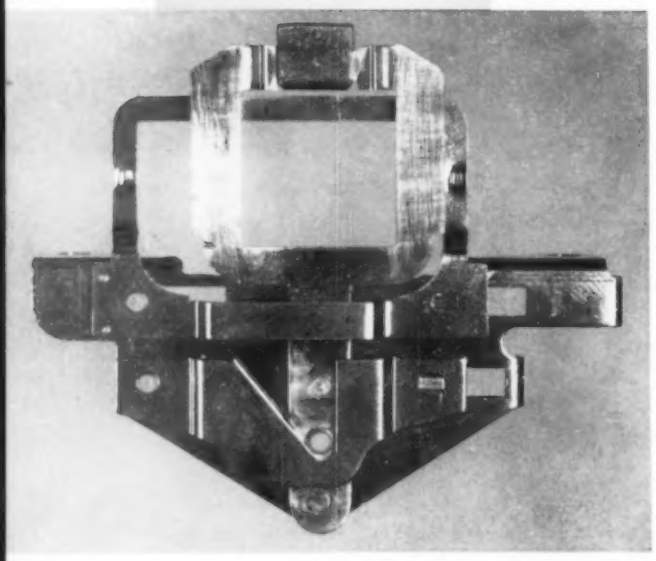
Since staking pressures can be controlled, the amount of excess metal also can be controlled. The operation is faster than mechanical staking; production is increased and the over-all cost of the operation is less. Loose stakes or joints are not a problem.

Fixture design time is less than required for press type fixtures. The simpler fixturing also allows the product design department more scope and flexibility when developing new products requiring assembly.

The nature of the equipment used in the operation is a disadvantage. Setup time for the welder is longer than for the setup of a conventional hy-



Two-electrode machine used for a hot upsetting operation. Linkage to the separate hydraulic cylinders used for controlling electrode travel is mounted on the upper portion of the machine frame.



Typical example of the type of assembly suited for hot upsetting. The workpiece is a light-load plate assembly for a watt-hour meter.

draulic or mechanical press for conventional staking. For these reasons, hot upsetting does not find economical application for short production runs. High initial cost may be another deterrent to extensive use of the process.

Generally, for light applications of hot upsetting or swaging of stranded lead wire, a machine with a capacity from three to ten KVA is recommended. For heavier work, a welder with a minimum capacity of 15 KVA is needed. In some applications, units as large as 300 KVA are necessary to supply sufficient force and heating capacity.

Controls on the welder being used for hot upsetting are also important. Type and size of the welder will determine the capacity of the controls. Synchronous welder controls must be used to obtain maximum machine usage and optimum quality. Flexibility of electrode heat and dwell time are prime requisites of hot upsetting and must be controlled accurately.

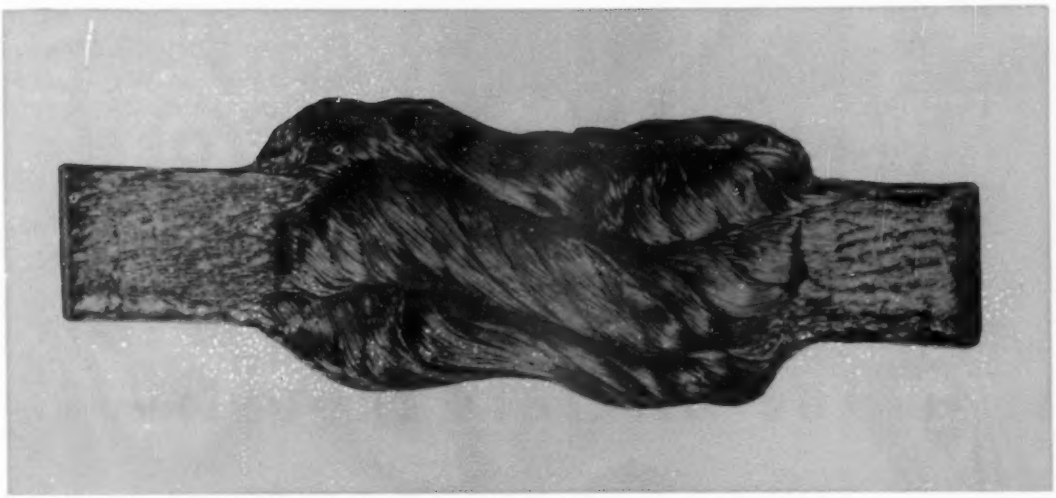
Separate air cylinders and controls on the welder electrode travel are important to the success of hot upsetting or swaging operations. The separate cylinder assures flexibility of the electrode contact pressure, which must be controlled for uniformity during the entire operation.

Electrode selection also plays an important part in the success of the hot upset operation. Both single and double-electrode welders are used. Design and size of the proper electrode are determined by the type of metal being upset. Almost all metals can be hot upset with the proper electrode and welder.

Proper maintenance of the welder electrodes will

Mechanical Staking versus Hot Upsetting

	Mechanical Staking	Hot Upsetting
Pressure, lb	2500	260
Fixture Cost, dollars	225	150
Equipment Cost, dollars	2000	3600
Labor Cost, dollars (per 100 pcs)	0.48	0.37
Joint Strength, in-lb	4.5	8.6



Example of a swaging and cutoff job on a stranded wire lead for a meter. The operations were performed on a two-electrode welding machine.

extend their productive life. An electrode dresser or a fine file may be used to redress the tool. Welder maintenance for hot upsetting or swaging operations is no different than maintenance for a regular welding operation.

Electrode cooling is needed where heavy work is performed. Water or a refrigerant can be used to obtain the proper tip temperature. Most light applications are performed without coolant, with no discoloring of the product. Water is the most commonly used cooling medium for swaging.

On operations where swaging of stranded flexible leads are performed, the types of wire, shape of the wire and sizes are limited only by the equipment available. Operations of swage and cutoff are often performed simultaneously on a welder having twin electrodes. One electrode holder is used for the swage electrode and the other holds the cutoff die. When operations of this type are contemplated, the tool planner should work with the welder manufacturer to be sure the welding unit will be suited to the operation.

Swaging and brazing are other operations that can be performed simultaneously on a twin electrode welder. When these two operations are performed together, the heat settings of each electrode must be accurately controlled to obtain a good product.

On some types of work, two single electrode welders may be together to perform hot upsetting or welding. In one application, this was done with an initial investment saving of $2000. Where properly applied, hot upsetting and swaging on a welder can be important sources of cost savings on many production assembly operations.

Advances in Molybdenum Technology Broaden Its Use

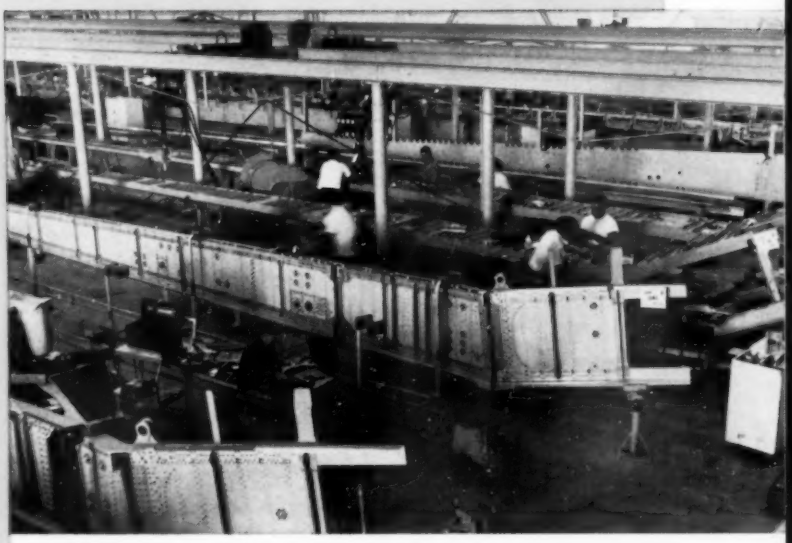
SCOPE OF APPLICATION for moly coatings has been broadened almost limitlessly because of new chemical processes being made available to the ingenious engineer. Dr. H. W. Schultz, manager of new chemical and catalyst development for Climax Molybdenum Co., places special emphasis on two promising processes for depositing molybdenum on other metals—hydrogen reduction of molybdenum pentachloride, and thermal decomposition of molybdenum hexacarbonyl.

In the first of these processes, with hydrogen as the reducing agent, the reduction by-product is hydrogen chloride which can be removed easily without contaminating the reduced metal. When reduction temperatures around 850 C are used, the resulting metal film is completely dense, with a well-developed grain structure. Molybdenum produced by vapor deposition is pure, and it can be deposited on metals, ceramics and graphite.

The second method of coating with molybdenum —through thermal decomposition of molybdenum hexacarbonyl—is also a vapor-phase process. Although it requires careful engineering and control, it can be modified to give coatings not only of molybdenum but also of molybdenum carbide or a combination of the two.

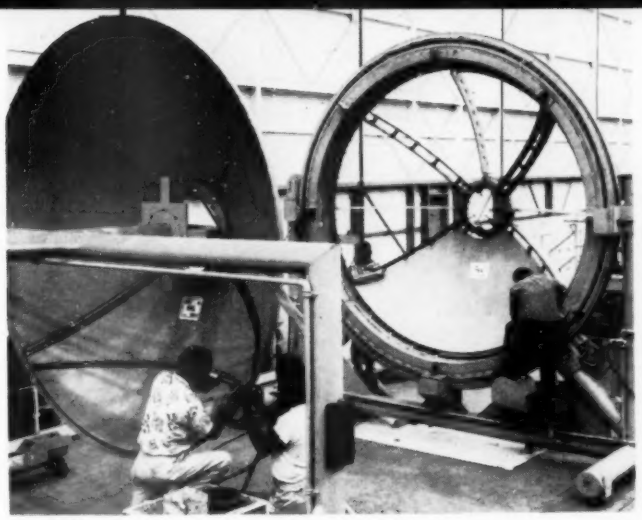
TOOLS at work

...in the aircraft industry

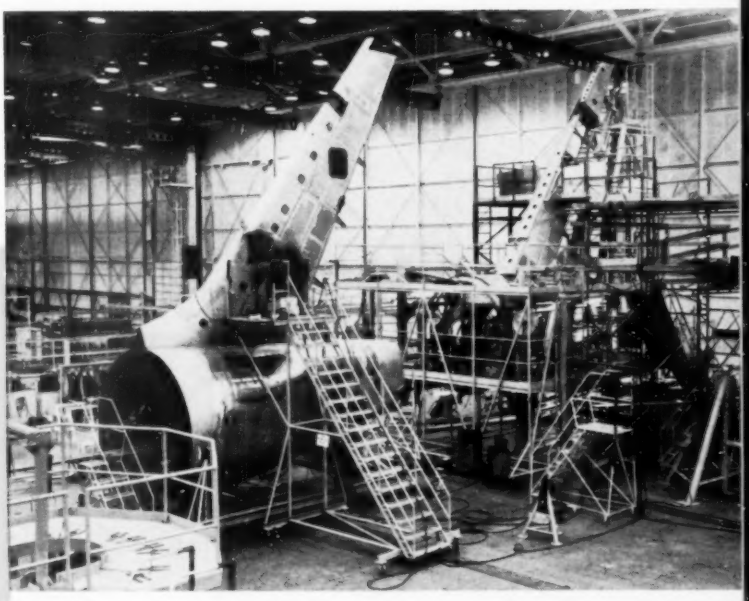


WING SPARS for the new Douglas DC-8 jet transport are built up on precision assembly fixtures at the company's Long Beach plant. In addition to acting as structural members, the spars are gigantic fuel tanks.

THE FUSELAGE of the DC-8 is made up of three major assemblies: the nose section (shown here), the cabin section and the tail section. Accuracy of assembly jigs is established by optical tooling, making sure that all mating assemblies fit together without difficulty.

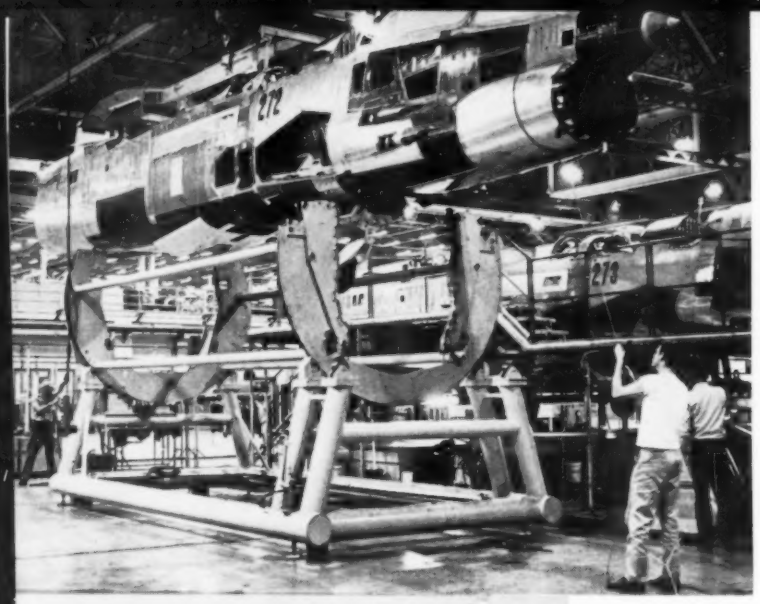


REAR FUSELAGE bulkheads are assembled in unusual tooling jigs. These jigs rotate, permitting assembly operators to reach all work areas without the need for elaborate platforms or scaffolding.



TAIL STUB of Douglas DC-8 is being assembled in precision jig at right. Minor additional operations are completed on tail stub in second position at left.

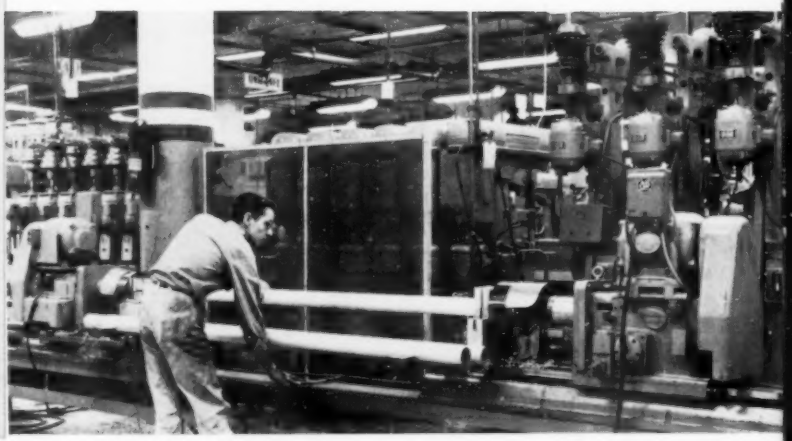
NEARLY COMPLETED fuselage, minus nose cone and tail section, is lowered onto wing spar. Special slings facilitate damage-free handling of fuselage by overhead crane.

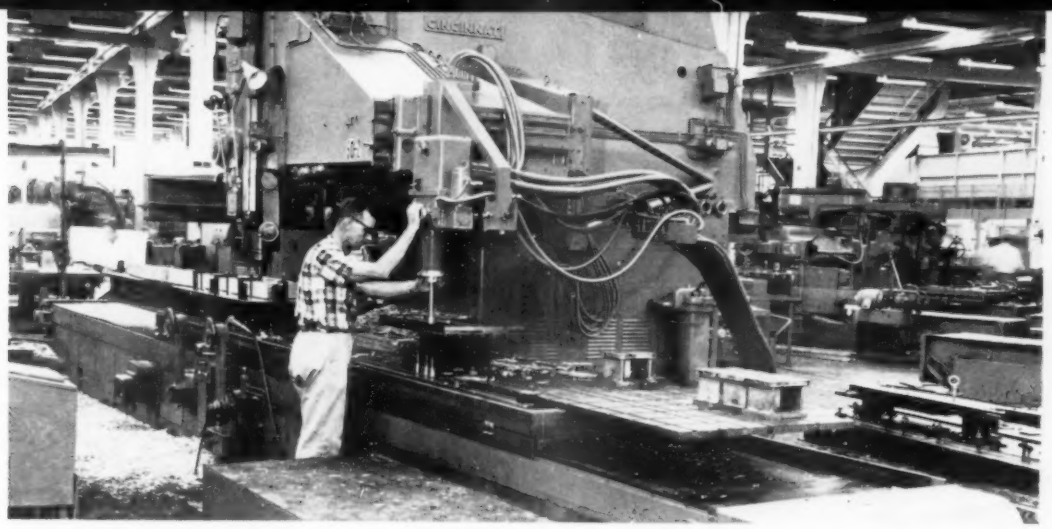


FUSELAGE of Chance Vought's F8U Crusader fighter plane revolves like a chicken on a spit and is simultaneously shaken by a mechanical vibrator. Purpose of this operation is to dislodge any debris, such as loose washers or bits of metal, that are accidentally left in plane by assembly workers. Fuselage is also vacuum-cleaned as a further precaution. This fighter is built at Chance Vought's Dallas, Texas, plant.

MAIN BEAM of Crusader wing is sanded on a special machine built from material salvaged around the Chance Vought plant. The sander eliminates the need for hand filing and is five times faster.

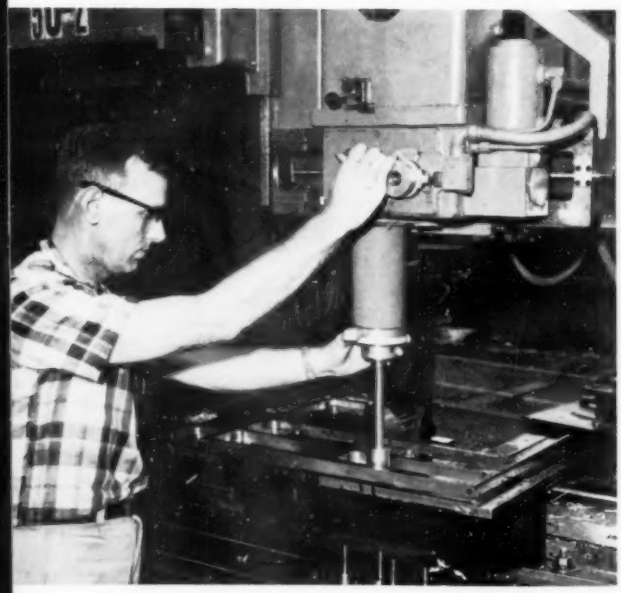
ANOTHER special machine built by Chance Vought is used to face and bore one end of a 10-foot rocket tube and face the other end. The first few tubes were machined on a turret lathe, but this method proved to be slow and expensive. The new machine holds tubes in an air clamp while both ends are machined simultaneously. These operations take 30 seconds; the previous method took five minutes.





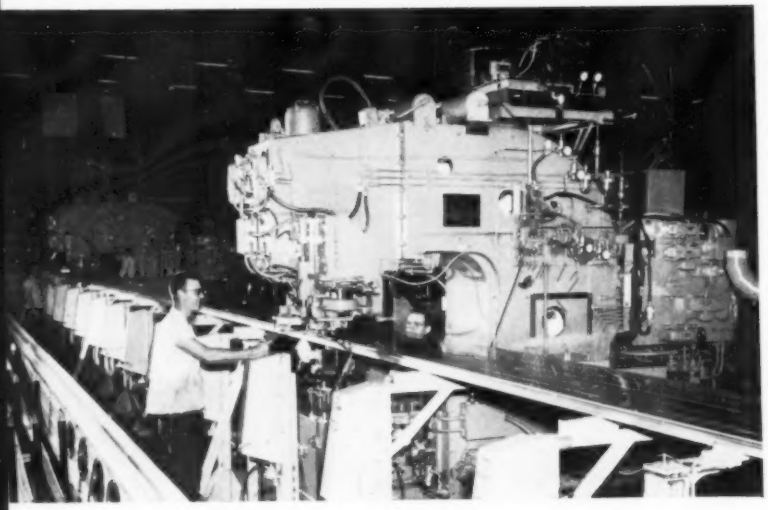
STEADILY INCREASING SIZE of modern airframe structures necessitated the purchase of two 33-foot-long Cincinnati Hydro-Tel milling machines by Martin's Baltimore Div. The machines, which automatically mill each part, are used principally on aluminum detail parts for the P6M SeaMaster, although they can also machine steel. Longitudinal table travel is 168 inches; cross ram travels 48 inches.

TOOLS at work



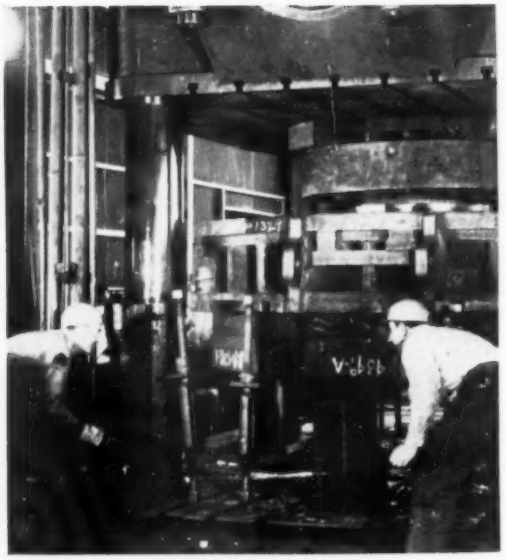
MARTIN OPERATOR sets the tracer control that guides the cutter and automatically mills a seaplane part. Operator must also adjust the cutting head in relation to the workpiece before starting the machine. Tracer control insures fast operation and a high degree of accuracy.

BALLISTIC SHELL of the Army Jupiter-C rocket was fabricated by Reynolds Metals Co. Here one of the 12 aluminum shells used to form the center section fuel tanks is spotwelded. Exactly 24,560 spotwelds are made on each Jupiter-C fuselage. Welds secure the skin of the missile to stiffener rings and braces.



RIVETER at Boeing Airplane Co.'s Wichita plant is tape controlled. The machine, one of four, automatically drills and countersinks a hole, inserts a rivet slug, upsets both ends, shaves off the outer head and then moves on to the next rivet. Eight to 10 rivets per minute are driven, fastening stiffeners to lower wing panels.

TOOLS at work



HEAVY NOSE CONES for the Air Force's Atlas and Thor ballistic missiles are being formed by Lukens Steel Co. for General Electric. Use of this 2000-ton hydraulic press for this work highlights the increasing use of steel plate for missile components, putting the steel industry in the missile business. Nose cones must withstand the shock of re-entry into the earth's atmosphere and protect nuclear warheads.

PRODUCTION of an aircraft part, a steel forging, has been simplified by use of a LeBlond-Carlstedt Rapid Borer at the Peter J. Salmon Co., Glenside, Pa. Formerly, the part was rough drilled, reamed, radius formed, ground and honed, using a turret lathe, a grinder and a honing machine. All operations are performed on one setup in the new machine and cycling is automatic. The operations are: solid boring a $\frac{5}{8}$-inch-diameter hole, counter-boring a 1-inch diameter, solid boring a 1-inch hole and radius forming. Feeds of $5\frac{3}{4}$ and 8 inches per minute are used. The part is $14\frac{7}{8}$ inches long, and is of 4130 steel, hardened to 39-43 R_C.

gun drilling

--feeds, speeds and coolants

GUN DRILLS can produce finished holes to close tolerances in one operation, eliminating reaming and honing in many cases. To use a gun type drill successfully, there are four requirements which must be met.

The Machine: The machine should have a spindle speed high enough to use the tool efficiently. This is especially true when drilling soft materials. Since a gun type drill operates with a 0-deg rake angle, chip velocity must be kept high enough to minimize pickup or weld on the cutting edge and avoid loss of size and finish.

Feed Mechanism: The feed mechanism must be of a constant, reliable type. This is most important in the sizes under ½-inch diameter. Any surges or jumps in the feed are likely to break the drill as the result of too heavy a chip load. This requirement precludes the use of hand feed or air cylinder feed unless the air cylinder is controlled with a hydraulic cylinder or by some similar means. If a mechanical feed is used, it should not be of the ratchet or intermittent type. TABLE 1 gives the recommended starting point for feed and speed. These conditions may be improved in actual application to reach optimum productivity.

Coolant: Coolant must be supplied to the drill in generous quantities. Volume requirements are shown in TABLE 2. This is perhaps the most important factor in gun drill operations and should not be underestimated. The volume and pressure of coolant required will vary with the size of drill,

Data courtesy Madison Industries Inc., Muskegon, Michigan.

Table 1—Speeds and Feeds for Gun Drilling

Type of Material	Hole Diameter (inch) Under 0.250		0.250 - 0.500		0.500 - 0.750		0.750 - 1.000		Over 1.000	
	Speed*	Feed*	Speed	Feed	Speed	Feed	Speed	Feed	Speed	Feed
Low Alloy Steel	300	0.0005	350	0.001	350	0.0015	350	0.002	350	0.002
High Alloy Steel	300	0.0004	300	0.0007	300	0.001	300	0.0015	300	0.002
High-Speed Steel	250	0.0003	250	0.0005	250	0.0007	200	0.001	200	0.0015
300 Stainless	200	0.0003	200	0.0003	200	0.0004	200	0.0005	200	0.0007
400 Stainless	250	0.0003	250	0.0005	250	0.0005	250	0.0008	250	0.001
Ductile Iron	250	0.0003	250	0.0005	250	0.0008	200	0.0015	200	0.002
Cast Iron	350	0.0008	350	0.0015	350	0.003	300	0.005	300	0.007
Cast Aluminum	600	0.001	600	0.002	600	0.003	600	0.005	600	0.008
Rolled Aluminum	600	0.0007	600	0.0015	600	0.002	600	0.005	600	0.007
Magnesium	750	0.001	750	0.002	750	0.003	750	0.006	750	0.010
Copper	400	0.0003	400	0.0005	350	0.001	350	0.001	350	0.0015
Bronze	400	0.0005	400	0.0008	400	0.001	400	0.002	400	0.002

*Speeds are in feet per minute; feeds are in inch per revolution

depth of hole, and material being drilled, as shown in TABLE 3. The coolant selected should have high antiweld and extreme pressure characteristics. There are a number of good sulfur-base, chlorinated cutting oils compounded especially for gun drilling. Use of the proper oil will increase tool life and improve hole finish. The viscosity can vary with hole size as shown on the table. To protect the pump and avoid scratched finishes and clogged drills, it is advisable to use a sump strainer or filter of at least 100-mesh screen or equivalent in the coolant sump.

Piloting: Since the gun drill must be piloted while cutting, it is necessary to furnish some piloting surface to start the drill. This is usually accomplished by means of a bushing, although it is possible to start from a counterbored hole. The bushing face should be as close to the work as possible. Frequently fixtures are designed to clamp the work against the bushing face, which is a most satisfactory arrangement. In any case, the bushing face should come within $\frac{1}{8}$ inch of the drill diameter from the face of the work. The most satisfactory material for bushings is wear-resistant tool steel. Bushings should be made 0.0002 over the maximum drill size and discarded or rebushed when they have worn 0.0005 to 0.0006 over the drill size. Worn bushings can cause bell mouth and misalignment.

Setups: Most successful gun drill applications are set up in a horizontal machine. Drilling can be done vertically if there is sufficient coolant to maintain good chip flow. A wide variety of setups are possible and the only limitation is the ingenuity of the designer. All setups will fall into one of two categories: work turning and drill turning.

Work turning is necessarily restricted to parts of such configuration as can be rotated at high speeds. This is the setup commonly encountered on gun lathes, engine lathes and the like. The greater number of new applications are where the drill is turning and the part remains stationary. This method allows an almost unlimited selection of work.

Table 2—Coolant Volume Requirements

Drill Size (inch)	Depth of Hole (inch)					
	6	12	18	29	36	43
	Volume (gpm)					
3/16- 1/4	2	3	3	3	3	3
9/32- 3/8	4	4	5	6	6	6
13/32- 1/2	5	6	8	10	11	11
17/32- 3/4	7	8	10	13	17	17
25/32-1	10	17	20	25	30	30
1 1/16-1 1/4	15	20	25	30	40	40
1 5/16-1 1/2	17	25	30	40	50	50
1 9/16-2	20	30	40	50	60	60

Table 3—Pressure and Viscosity of Coolant

Type of Material	Hole Diameter (inch)									
	0.156 — 0.250		0.250 — 0.500		0.750 — 0.500		0.750 — 0.1000		Over 1.000	
	Viscosity	Pressure*	Viscosity	Pressure	Viscosity	Pressure	Viscosity	Pressure	Viscosity	Pressure
Low Alloy Steel	75-100	500-800	75-125	500-600	90-200	300-500	120-200	300-400	140-250	300
High Alloy Steel	75-100	500-800	75-125	500-600	90-200	300-500	120-200	300-400	140-250	300
High-Speed Steel	75-100	500-800	75-125	500-600	90-175	300-500	120-200	300-400	140-200	300
300 Stainless	75-100	500-800	75-125	500-600	90-175	300-750	120-200	300-500	140-200	300
400 Stainless	75-100	500-800	75-125	500-600	90-175	300-750	120-200	300-500	140-200	300
Ductile Iron	75-100	500-750	75-125	500-600	75-200	300-600	90-200	300-500	120-200	300
Cast Iron	75-100	500	75-125	300-600	75-200	200-600	90-200	250-500	120-200	200
Cast Aluminum	50-100	500	50-125	300-500	50-200	300-500	75-200	250-400	75-200	300
Rolled Aluminum	50-100	500	50-125	300-500	50-200	300-400	75-200	200-400	75-200	300
Magnesium	40-100	400-500	40-125	300-500	40-175	300-400	40-200	250-400	75-200	300
Copper	75-150	500-800	75-150	300-750	90-200	300-750	120-200	250-500	120-200	300
Bronze	75-150	500-750	75-150	300-750	75-200	300-750	90-200	250-500	90-200	300

*Pressure is psi; viscosity is sec at 100F SUV

Western Tool Show and Convention Section

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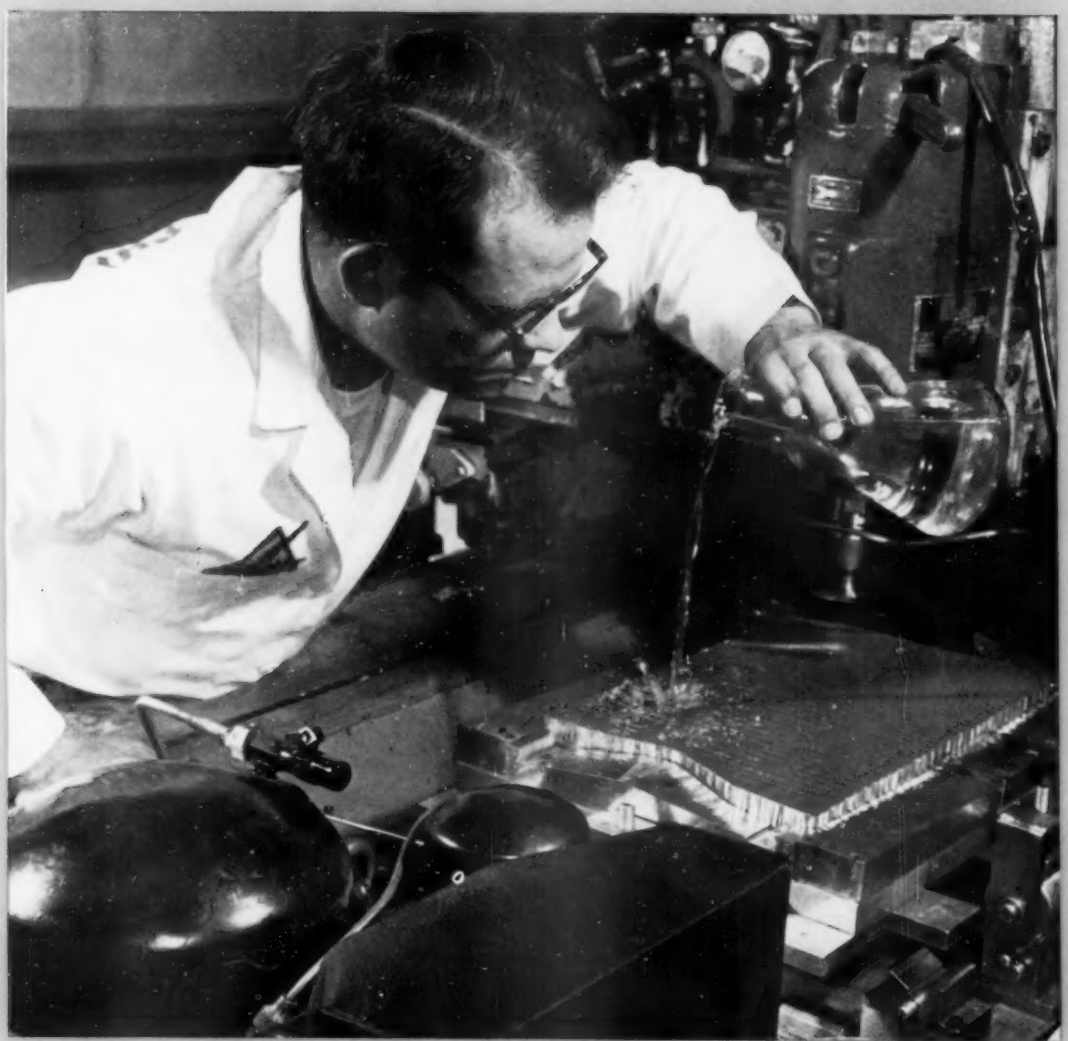


California-developed technique—freezing water-filled honeycomb blanks for easier machining of aircraft components is demonstrated by Northrop operator. (See Plant Tour #9, Page 133.)

Optimism marks Western

THE ASTE's second Western Tool Show—the first one was held in the spring of 1955—will open at Los Angeles September 29 in an atmosphere that is not exactly reminiscent of Gold Rush days. But despite the doldrums brought on by months of economic smog, there are definite rays of sunshine.

Some 250 exhibitors will spread their wares over 90,000 square feet of floor space in the ponderous Shrine Exposition Hall. And they will be full of hope—fraught with hope, as one of them put it—that 15,000 people will come by to see and buy.

A lugubrious but aggressive exhibitor is banking heavily on the Los Angeles show to bail him out of a bad year. "It's California or bust for us," he said, "and bust means just that."

For the West Coast in particular, things are looking up. Six-figure contracts are being let in the missile and aircraft industry, much of which is concentrated in California. Many of these contracts deal with development, but carry the potential of billions of dollars more that should follow for production.

Despite the fact that most of the big aircraft companies are "between contracts," there is little evidence of a recession. Some small job shops are hurting because the "primes" (prime contractors for aircraft) have pulled some jobs into their own plants that would be farmed out in times of peak activity.

But the first thing a visitor sees as he leaves the Los Angeles International Airport is a sign reading "Production Workers Wanted." Such signs—and others—point to an economy that does not feel the impact of the recession as it is felt back East.

Los Angeles—host city to ASTE's West Coast Tool Show, is a sprawling metropolitan giant laced together by miles of freeways and distinguished by an explosive burgeoning of new industry.

Show's opening

Optimism also stems from such facts as these:

- Forecasts for better times are coming not only from habitual tub-thumpers, but cautious government agencies and feet-on-the-ground businessmen as well.
- The stock market continues to register new highs.
- Retail trade gets stronger; personal income continues to rise; the outlook for one vital industry—construction—is bright.
- Seventy-two out of 100 corporation executives polled recently expressed the belief that sales in all lines will increase as the year wanes.

It is appropriate that the Tool Show's theme is "Tooling for the Space Age." Not only does it rest solidly on the state's present ascendancy in rocketry and other fields of flight, but it is characteristically Californian in another way: it carries on the onward-and-upward tradition of a long line of themes that have epitomized the West, such as Go West Young Man, Mother Lode, Westward Ho, California or Bust. . . .

The Tool Show comes at the right time (Sept. 29-Oct. 3, after the summer dog days are over) and the right place (Los Angeles, which is certainly not known for gloom or trepidation) to help accelerate the economic recovery of the nation.

There are other reasons why the 1958 show should outshine its 1955 forerunner in attendance and sales. For one thing, there's precedent now. Los Angeles knows the ASTE, and many influential West Coasters remember the magnitude and scope of its tool exposition. Among these influential people are engineers—Los Angeles County has more engineers than any other like area in the world—and about 100,000 top echelon manufacturing executives who are chafing for new ways to produce more and for new money-saving ideas.

For another thing, Tool Show hours have been changed. Instead of 9 to 6 every day, as in 1955, the Exposition Hall will be open from 1 to 10 p.m. for the first three days of its five-day run. The afternoon and evening hours should permit plant personnel to handle appointments and other business in the morning, and still allow time for them to span even the sprawling Los Angeles area, if necessary, to attend the show.

Important, too, are the extra added attractions. Technical sessions, plant tours, and convention activities of the ASTE will effectively supplement the show itself.

The Shrine Exposition Hall will house the myriad displays of machines and equipment. Its doors will be open from 1 to 10 pm the first three days of the Show, for additional viewing by those metropolites whose jobs keep them busy day by day.

Most important assurance of success, however, is that there's a whale of a market. Metropolitan Los Angeles' growth has always been dramatic, but the last decade has topped them all. Since 1948, the area has become the nation's third largest industrial center; has welcomed more than 5000 new plants including a dozen giants; has added 1,810,000 new residents until there are 5½ million in the area now; has seen manufacturing employment shoot up 101.4 percent, from 360,000 to 725,000; has spent $2 billion in capital investments.

Keynote of the industrial spurt has been business leaders' foresight in developing engineering and scientific talent to keep the West Coast technically ahead of the times.

Survey of a typical growth year, 1956, showed that aviation led a field of 19 major industries in capital investment, with $76 million invested in new plants and expansions. The automotive industry ranked second during that year, with $40 million plus invested, followed closely by a $38 million investment in the construction of new and expanded metal products firms. Almost in a tie for third place was electronics. Chemicals and paints ranked fifth, petroleum products, sixth.

Creative endeavor has patterned the area's phenomenal growth, and will be much in evidence at the ASTE's show. Space in Exposition Hall may well be a reservation in a space ship.

Registration will be conducted at both the Shrine Exposition Hall and the Biltmore Hotel's Conference Room 3. The show closes at 6 p.m. Friday, Oct. 3.

Convention headquarters—Biltmore Hotel, Los Angeles

Convention Highlights

FOR CAREER tool engineers, the gage of any convention's success is the number and scope and caliber of the technical sessions. The fifty-six papers to be presented at the Western Tool Show and Semiannual Convention are expected to measure up to the specifications of such serious-minded visitors. In keeping with the theme, "Tooling for the Space Age," many of the papers deal with just that. Many of them have been prepared by thinkers and doers in various phases of the aircraft industry—that industry where the most interesting, ingenious and advanced tool engineering in the country is being done today.

Problems are accentuated in missile and advanced aircraft manufacture. Materials with the best characteristics from a functional point of view are the hardest to fabricate from a manufacturing point of view. Tolerances are stringent. Fuel tanks must not leak, and the mating surfaces of aircraft skins must join without a crack, or air drag will rip the ship apart. And so on.

Tool engineers, who may be good in other industries, are perhaps becoming even better in the aircraft industry—for the simple reason that the greater the challenge, the better the effort. At any rate, they are tooling up for tomorrow's aircraft—on a production basis—using manufacturing techniques that were virtually undreamed of until recently. The challenge is indeed illimitable; the ultimate challenge, as all aircraft engineers seem to know, is the conquest of space. . . .

The technical papers comprise five panel discussions—"Tooling Space Airframes," "Metal Forming," "Tool Engineering for Numerical Control," "Economics of Modern Tooling," "Fabricating Characteristics of Some New Materials"—plus conferences on electronics, plastics in tooling applications, education, chemical milling, and sandwich construction.

The American Welding Society will participate in a conference on welding and joining, and the American Society of Quality Control will join in sponsoring the papers on quality control.

Other papers are grouped into symposia, on "Metal Forming" and "Metal Removal."

All the Los Angeles technical sessions will be presented in either the Shrine Auditorium or the Biltmore Hotel.

Education Counselors Program

In addition to technical papers on education, a special panel discussion entitled "Preparing for a Career in Tool Engineering," will be presented in the Shrine Auditorium on Monday afternoon.

This Education Counselors Program, a variation of the popular Career Days held at past conventions, will be moderated by Prof. Arthur F. Gould, chairman of the national education committee and head of the industrial engineering department, Lehigh University. Panel members will be Prof. Frederick Preator, head of tool engineering, Utah State University and past member of the ASTE

education committee: Carl F. Kaiser, member of the education committee and associate professor of engineering, San Jose State College; and J. Everett Hollingsworth, dean of business and technology, Long Beach City College. Attending by invitation will be area school education counselors.

Governor Is Keynote Speaker

Billed as ASTE's "blast-off" into the week of activities and learning experiences in "Tooling for the Space Age" is the California Day luncheon scheduled at 11:30 a.m., Monday, in the Shrine Auditorium. Keynote speaker at the salute to Western industry and education will be Gov. George D. Clyde of Utah, a former engineering college dean.

President George A. Goodwin will deliver the Society welcome, and Wayne Ewing, ASTE vice president, will be toastmaster.

14 Plant Tours Scheduled

Complementing the new ideas to be derived from the Tool Show exhibits will be 14 tours of interesting plants and installations in the area. Buses for the tours will depart from the Biltmore and return to the Shrine hall, except for Tours #12 and #13 which will both depart from and return to the hotel. Round-trip transportation is $1 per tour, and tickets may be bought at the point of departure. Details of the tours will be found in the following pages of the "California Convention Calendar."

Meeting of the Membership

Of prime importance to the 3679 members of the dozen ASTE chapters in California, as well as to the 36,000-odd other members in the rest of the Society's chapters, is the semiannual meeting.

All members are welcome to attend the 9 a.m. to 5 p.m. sessions of the ASTE Board of Directors, scheduled for Wednesday and Thursday, Oct. 1 and 2, in the Galeria Room of the Biltmore.

The semiannual meeting banquet will be held at Hollywood's Moulin Rouge on Thursday evening.

Frequent shuttle bus service will be offered between the Shrine hall and the headquarters hotel during the exposition.

Host Committee busy on coast

THIRTY-FOUR PEOPLE have taken on host committee jobs for the ASTE's Western Tool Show. Cooperating chapters besides Los Angeles are Golden Gate, San Diego, Long Beach, San Gabriel Valley, Santa Clara Valley, San Fernando Valley, Santa Ana Valley, Riverside, Centinela Valley, Sacramento, and San Francisco.

Host committee general chairman is John H. Stansbury. Other officers are Lawrence D. Pomerantz, national program committee zonal member; Edwin L. Cutler, vice chairman; James H. Medford and Raymond E. Gariss, secretaries, who also will serve as emergency chairmen and as records and reports chairmen.

Division A chairmen, with Paul E. Lenk as coordinator, include: Ralph E. Chrissie and Alfred E. Beaumont, tickets; Glen B. Crider and Lloyd R. Warner, transportation; Ann Regen, Peggy Edgcomb, and Marie Lenk, ladies' activities; George J. Tilden and Tommy Tomlinson, plant tours; B. Ken Allen and Robert A. Edgcomb, education.

Division B chairmen, with Rudolf Regen and Alfred T. Rando as coordinators: Alfred H. Petersen and George C. Adams, technical sessions; Vernon M. Sells and Earle B. Williams, sessions arrangements; Ray Journeay and Arthur E. Crom, signs; Carl L. Almquist, banquet coordinator.

Division C chairmen, with Russell J. Stainton and Jack D. Bailey as coodinators: Richard R. Cannon and Charles McNealy, Jr., reception; Carl E. Blanchard and James H. Rust, budget; Gene O. Grahn and Irvin Also, publicity.

Among Los Angeles host committee members are (left to right) Gene Grahn, publicity; Jim Rust, budget; Irv Also, publicity; Chuck McNeely and Tom Sweet, reception.

California Convention Calendar

monday september 29

Tooling Space Airframes

2 p.m. Shrine Auditorium

"Design to Tool for Producibility," by C. F. Marschner, department manager, production engineer, Lockheed Missile Systems Div., Lockheed Corp.

"Tooling the Atlas," by L. G. Granstedt, chief tool engineer, Convair.

"Tooling for the Snark Is an Inside Job," by A. S. Turner, assistant chief tool engineer, Northrop Div., Northrop Aircraft, Inc.

Co-Chairmen: John H. Stansbury, tool engineer, Douglas Aircraft Co., and Bernard Gaiennie, research and development administrator, Northrop.

Metal Forming Symposium I

2:30 p.m. Music Room, Biltmore Hotel

"New Stretch Forming Machinery," by C. E. Blanchard, chief engineer, Sheridan-Gray, Inc.

Chairman: O. A. Wheelon, research consultant.

Sandwich Construction

7:45 p.m. Shrine Auditorium

"Honeycomb Sandwich Fixtures at 2000° F," by F. J. Filippi, project liaison engineer, Solar Aircraft.

"Construction for Multi-Curved Parts," by E. Carmichael, director, and C. Fredericks, assistant director, Narmco R. & D. Laboratories.

Chairman: E. W. Fedderson, chief of manufacturing research, Convair.

Metal Forming Symposium II

8 p.m. Music Room, Biltmore Hotel

"Precision Cold Extrusion Technology for High Temperature Metals," by Raymond A. Quadt, vice president, research and development, Hunter Douglas Aluminum Corp.

"Tube Bending; Plumbing—Art or Science?" by J. E. Hawking, sales manager, Pines Engineering.

Chairman: Fred C. Pipher, design specialist, producibility methods, Lockheed Aircraft Corp.

plant tour for monday

Tour #1—8 a.m. to noon. Byron Jackson Div., Borg-Warner Corp., Vernor Ave. plant.

Limit 200 visitors. Diversified manufacturing produces basic equipment in the fields of agriculture, petroleum, mining, power, nuclear and general industry. Visitors will see centrifugal pumps, oil well tools, full-size oil field derrick, submersible electric motors, nuclear power special pumps, highly specialized mechanical seals.

tuesday september 30

Metal Forming Symposium III

9 a.m. Renaissance Room, Biltmore Hotel

"Explosive Forming of Metals," by Keith A. Wilhelm, consultant.

"Problems to Routine—A Continuous Transition," by Joseph W. Schiffel, chief engineer, special products, Ingersoll Kalamazoo Div., Borg-Warner.

Chairman: Vernon H. Monteil, research engineer, Rocketdyne Div., North American Aviation, Inc.

Plastics in Tooling Applications

9:30 a.m. Music Room, Biltmore Hotel

"Special Tooling Requirements for Molding High Temperature Resistant Plastic Reinforced Materials," by John B. Williamson, technical representative, United States Polymeric Corp.

"Tooling for Glass Fiber Laminates," by Robert P. Routt, materials and processes engineer, Lockheed Aircraft Corp.

Chairman: Carrol Sachs, research specialist, Lockheed Aircraft Corp.

Metal Forming Symposium IV

2 p.m. Shrine Auditorium

"The Challenging Future of Power Spinning," by John N. Heater, western field engineer, Meta Dynamics Div., Cincinnati Milling & Grinding Machines, Inc.

"Floturn Process," by Claus Sporck, vice president and chief engineer, Floturn Div., Lodge & Shipley Co.

"Hot Roll Spinning Titanium," by Fred Spiegl, executive vice president, Titanium Fabricators, Inc.

Chairman: J. L. Morris, staff member, Los Alamos Scientific Labs.

Quality Control

2:30 p.m. Music Room, Biltmore Hotel

(Participation by American Soc. of Quality Control)

"Egg-Crate Sampling as an Aid to Production Engineering," by William R. Baker, director of quality control, subsidiary of Parker-Hannifin Corp.

"Gage and Tolerance Control Between Prime and Subcontractors," by S. H. Neffeler, chief quality control, Missile Systems Div., Lockheed Aircraft Corp.

Chairman: Henry E. Matosoff, chief quality engineer, Cannon Electric Co.

Metal Forming Symposium V

7:45 p.m. Shrine Auditorium

"Precision Forgings—Solution or Delusion?" by Alfred G. Jones, senior engineer, Design Producibility, North American Aviation, Inc.

"Fabricating Techniques for High-Strength Superalloys," by H. E. Haley, assistant sales manager; and F. S. Boernicke, Technical Communications Section, Haynes Stellite Co.

Chairman: S. R. Carpenter, supervisor producibility, Convair, Div. of General Dynamics Corp.

Tooling Aids and Developments

8 p.m. Music Room, Biltmore Hotel

"Recent Development in Use of Optics as an Engineering Tool," by A. W. Young, supervisor of engineering sales, Engis Equipment Co.

"Closed Circuit TV as a Tool," by K. H. Boucher, chief tool engineer, Douglas Aircraft Co., Inc.

"Optical Tooling for General Industry," by W. L. Egy, executive vice president, Brunson Instrument Co.

Chairman: Ralph A. Hamilton, manufacturing standards engineer, Lockheed Aircraft Corp.

plant tours for tuesday

Tour #2—8 a.m. to noon. Douglas Aircraft Co., Inc., Long Beach Div.

Limit 100 visitors; must be U.S. citizens. This installation, one of the largest of its kind in the country, is used to produce the new DC-8 Jet-liner. The facility has a total of 26¼ acres, or 1,143,043 sq ft of floor space. It is the first plant in the nation to be built by an aircraft company for the exclusive manufacture of commercial jet transports.

Tour #3—8 a.m. to noon. Long Beach Naval Shipyard.

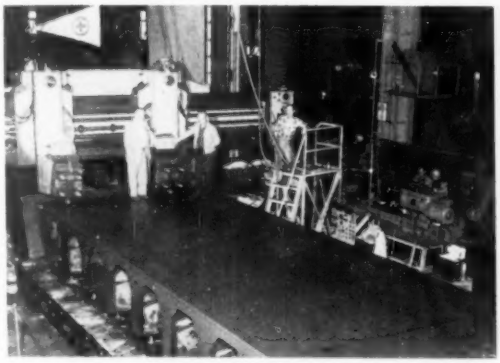
Limit 200 visitors. No cameras permitted. The shipyard, covering 363 water-front acres, provides logistic support including drydocking, overhaul and conversion for all vessels of the fleet. Visitors will see one of the largest drydocks in the world, as well as marine industrial buildings, piers and well-equipped machine shops. One shop includes a Niles planer with a 36-ft bed and a 19-ft Betts boring mill.

Tour #4—1 p.m. to 5 p.m. American Can Co.

Limit 150 visitors. No cameras permitted. This Los Angeles plant is one of the largest container manufacturing plants in the world. Visitors will witness the manufacture of cans of various sizes from stock sheet metal to finished can, including the lithograph printing on sheet metal. Also included in the tour will be the manufacture of fiber milk cartons from rolled paper stock to completed printed paraffined milk carton. Company-owned facilities include timber tracks, a railroad, pulp mills, paper mills and converting plants, chemical and ink manufacturing plants, plastic manufacturing plant and an extruded metal tube manufacturing plant.

Tour #5—1 p.m. to 5 p.m. Ford Motor Co., M-E-L Div.

Limit 150 visitors. No cameras permitted. The entire production operations at this plant are devoted to the assembly of Mercury passenger cars. The functions performed within the plant are completely related to the assembly of finished units and do not include the manufacture or fabrication of component parts. The plant tour will include an observation of body construction, paint, trim and final assembly, all of which is performed on a moving line basis.



This 36-foot-long Niles planer, capable of machining a 300-ton casting, is one of the "giant killers" with which the Long Beach Naval Shipyard's inside machine shop is equipped. See Plant Tours #3 and #7.

wednesday october 1

ASTE Board of Directors
Semiannual Meeting
Wednesday and Thursday, October 1 and 2
9 a.m. to 5 p.m. Galeria Room, Biltmore Hotel

All members welcome to attend

Tooling for Electronics I

9 a.m. Renaissance Room, Biltmore Hotel

"Automatic Production through Electronics," by William C. Leone, head of engineering, Industrial Systems and Controls, Hughes Tool Co.

Chairman: Edward D. Heller, manager, manufacturing development department, Convair, Pomona Div., General Dynamics Corp.

Metal Removal Symposium I

9:30 a.m. Music Room, Biltmore Hotel

"Recent Progress in Cutting Tool Materials," by Paul A. Kafader, Jr., carbide service engineer, Firth-Sterling, Inc.

"Grinding Techniques for Advanced Materials," by J. A. Mueller, manager, grinding laboratory, Product Engineering Branch, Bonded Abrasive Div., The Carborundum Co.

Chairman: F. G. Fenger, vice president-manufacturing, Menasco Mfg. Co.

Tool Engineering for Numerical Control

2 p.m. Shrine Auditorium

"The What, Where and How of Compatibility in Numerical Control," by E. F. Carlberg, chief of the numerical control staff, Boeing Airplane Co.

"The Three R's of the Systems Builder," by D. E. Laughlin, digimatic marketing manager, Electronic Control Systems, Inc.

"Scope of Numerical Control Systems," by Bernard Gaiennie, administrator, research and development, Northrop Aircraft, Inc.

Chairman: J. J. Yaeger, vice president and chief engineer, Pratt Whitney Co., Inc.

Metal Removal Symposium

2:30 p.m. Music Room, Biltmore Hotel

"New Milling Techniques," by Dr. A. O. Schmidt, research engineer, Kearney & Trecker Corp.

"Nonmechanical Machining Methods for New Metals," by Lynn A. Williams, president, Anocut Engineering Co.

Chairman: Glen B. Crider, president, Lord, Crider.

Tooling for Electronics II

7:45 p.m. Shrine Auditorium

"Management Meets a Challenge—Bridging the Gap Between Theory and Manufacturing," by R. N. Marshall, superintendent-headquarters engineering, Radio Div., Western Electric Co., Inc.

"Tooling Electronics for the Vacuum of Space," by T. F. Vajda, supervisor of tooling and manufacturing methods, Missile Div., Lockheed.

Chairman: David H. Brown, assistant general manager, Bendix Aviation Corp.

Metal Removal Symposium III

8 p.m. Music Room, Biltmore Hotel

"Cutting Fluids," by A. W. Ackerman, director of research, Anderson Oil & Chemical Co., Inc.

"Machining of Metals for Advanced Aircraft and Missiles," by Norman Zlatin, vice president; and Leonard Nowikowski, vice president-engineering research, Metcut Research Associates, Inc.

"Industrial Filtration in the Metalworking Industry," by C. A. Wallace, manager, Filtration Div., U. S. Hoffman Machinery Corp.

Chairman: John R. Bethune, manager, quality control, A. C. Applied Research Laboratories.

Tour #6—8 a.m. to noon. Crown Zellerbach Corp., Converting Div.

Limit 100 visitors. In this converting and warehousing plant over 150 tons of paper are converted from jumbo rolls into the following products: household roll towels, napkins, interfold towels, grocery bags, lunch bags, carry bags and tabulating cards. This corporation is the second largest pulp and paper manufacturer in the United States.

Tour #7—8 a.m. to noon. Long Beach Naval Shipyard (Repeat of Tour #3).

Tour #8—1 p.m. to 5 p.m. Lever Bros. Co.

Limit 150 visitors. No cameras permitted. Plant is western in spirit and design. Many of its operations are housed outdoors to take advantage of the California climate. The equipment combines the highest standard of performance with the greatest possible safety. (Considerable walking; not recommended for the elderly.)

Tour #9—1 p.m. to 5 p.m. Northrop Aircraft Co., Hawthorne plant.

Limit 200 visitors. Northrop specializes in military aircraft, guided missiles and related products. This includes research development and production of complete weapons systems for all branches of the armed services. The engineering center, engineering laboratory, the engineering test facility and hypo-turbulence wind tunnel are points of interest, as well as sections of the production department of the SM-62 Snark missile.

Electronic packages, easily accessible and removable for replacement and maintenance, play an important role in Northrop Aircraft's control center developed by Bendix. Information from pre-punched laminated tape is transmitted electronically to motors on a huge profile milling machine. See Plant Tour #9.

Sprawling Long Beach Naval Shipyard is a major industrial activity of the area with an annual payroll of $35 million. Youngest of the Navy's 11 shipyards, the $170 million plant includes machine tools of practically every size and description. Shipyard covers 363 waterfront acres. See Plant Tours #3 and #7.

thursday october 2

Metal Removal Symposium IV

9 a.m. Music Room, Biltmore Hotel

"A Theoretical Approach to the Solution of Machining Problems," by Robert L. Vaughn, production methods engineer, Lockheed Aircraft Corp.

"Machining of High Tensile Materials," by Roger W. Runyan, research tool engineer, Menasco Mfg. Co.

"Performance Characteristics of Ceramic Tools in Turning and Milling," by E. J. Krabacher, and W. A. Haggerty, The Cincinnati Milling Machine Co.

Chairman: Chuck H. Morlath, manufacturing engineer, North American Aviation, Inc.

Education

9:30 a.m. Shrine Auditorium

"Tools for the Tool Engineer," by Jack Kadushin, supervisor, engineering and electronics training, Lockheed Aircraft Corp.

"New Frontiers in Engineering Education," by Prof. Morris Asimow, University of California.

Chairman: Dr. F. Lindvall, California Institute of Technology.

Economics of Modern Tooling

2 p.m. Shrine Auditorium

"Forecasting and Estimating of Tooling for Airframe and Missiles," by C. E. Johnson, Sr., assistant chief tool designer, McDonnell Aircraft Corp.

"Tool Planning for Modern Missiles," by A. H. Dunn, tool engineering general supervisor, Convair, General Dynamics Corp.

"Tool Design and Making," by Jack Lewis, manufacturing engineer, Missile Systems, Lockheed.

Chairman: George W. Papen, department manager, production engineering, Lockheed.

Metal Removal Symposium V

2:30 p.m. Music Room, Biltmore Hotel

"Coated Abrasive Machining," by John M. Pitblado, manager, industrial trades, Coated Abrasive and Related Products Div., Minnesota Mining and Mfg. Co.

"Tooling for Sculptured Structures," by Fred E. Pauls, manufacturing manager, National Tapered Wings, Inc.

Chairman: R. J. Wendell, project tool engineer, Douglas Aircraft Co., Inc.

plant tours for thursday

Tour #10—8 a.m. to noon. Consolidated Electrodynamics Corp.

Limit 100 visitors. In an atmosphere that is particularly conducive to creative research and development, skilled craftsmen assemble precision electronic equipment. This company has become increasingly active in the missile field and reports that 90 percent of long-range missile firings are recorded on their equipment.

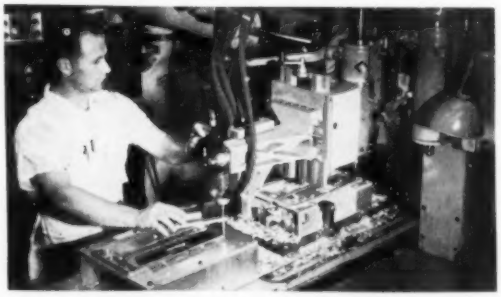
Tour #11—8 a.m. to noon. Hughes Products Div., Hughes Aircraft Co.

Limit 40 visitors. No cameras permitted. A leading manufacturer of air-borne weapon systems and guided missiles for the military, ground systems for aircraft surveillance and control, and components, instruments and systems for commercial and industrial electronics.

Tour #12—1 p.m. to 5 p.m. Lockheed Aircraft Corp.

Limit 35 visitors. Must be U. S. citizens. Over 30,000 airplanes of more than 70 types have been made by the California Div. of this aircraft company, including the new Electra prop-jet airliner. Designed to carry from 66 to 98 passengers, the Electra travels up to 2700 miles without refueling, at speeds of 100 to 500 mph. Visitors will see the final assembly of this aircraft and then watch activities on the flight line.

Tour #13—1 p.m. to 5 p.m. Hughes Products Div. (Repeat of Tour #11).



Automatic profiling machine at Consolidated Electrodynamics Corp. performs 14 separate operations—produces oscillograph body sections in a tenth the time required by former methods. See Plant Tour #10 at left for more information.

ASTE's
Semiannual Meeting Banquet
thursday, october 2
6 p.m. social hour 7 p.m. dinner
at
Moulin Rouge, Hollywood

toastmaster
Harry E. Conrad, executive secretary, aste

entertainment beginning at 8:30
a new Moulin Rouge revue presented for the first time

dress optional tickets $10

friday **october 3**

Chemical Milling

9 a.m. Music Room, Biltmore Hotel

"Tooling for Chemical Milling," by George E. Larsen, research analyst, Northrop Aircraft, Inc.

"Chemical Milling—Key to Space Age Design," by Lew B. Stearns, chief engineer, United States Chemical Milling Corp.

Chairman: Vern E. Dress, materials and process engineer, California Div., Lockheed Aircraft Corp.

Welding and Joining I

9:30 a.m. Main Auditorium, Shrine Auditorium

(Participation by American Welding Society)

"Welding Tooling for Missiles," by Byron Russell, president, Airline Welding and Engineering.
Paper title to be announced, by Henry James, Sciaky Bros., Inc.

Chairman: M. L. Ochieano, production design engineer, California Div., Lockheed Aircraft Corp.

Fabricating Characteristics of Some New Materials—Panel Discussion

2 p.m. Main Auditorium, Shrine Auditorium

"Beryllium Fabrication," by Dr. K. G. Wikle, manager, Metallurgical Process Development Div., Brush Beryllium Co.

"Fabrication of Refractory Metals," by William L. Bruckart, development engineer for the Refractomet Division of Universal-Cyclops Steel Corp.

"Making of Aircraft Structures from Inconel X," by Robert R. Ferlguson, senior research engineer, Materials and Process Group, North American Aviation, Inc.

Chairman: Alan V. Levy, supervisor, Materials and Process Section, Marquardt Aircraft Company.

Welding and Joining II

2:30 p.m. Music Room, Biltmore Hotel

(Participation by American Welding Society)

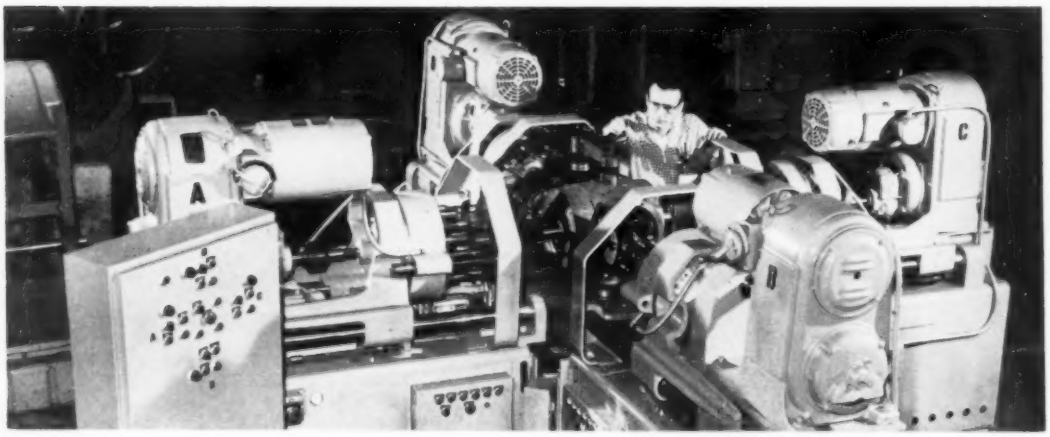
"Tooling for Welded Aircraft Missile Pressure Vessels," by Gerald Garfield, chief engineer, Research Welding and Engineering Company, Inc.

"Ultrasonic Welding Techniques," by W. C. Potthoff, vice president; and J. Byron Jones, president, Aeroprojects, Inc.

Chairman: Charles B. Smith, assistant chief, materials and process engineer, Douglas Aircraft Co., Inc.

Tour #14—8 a.m. to 12:30 p.m. U. S. Electrical Motors, Inc.

Limit 200 visitors. This company manufactures motors for industry from ¼ to 500 hp, including standard motors, gear motors and variable speed drives. The plant facilities include specialized machinery, much of which is automatically controlled. Visitors will witness a demonstration of the company's products as applied to various operations. A point of interest will be a huge semiautomatic annealing furnace used to normalize motor castings. Once loaded with parts, each flat car is automatically controlled through the three-stage furnace for proper preheating, soaking and cooling of the iron castings.



This gear case drilling and tapping machine, at U.S. Electrical Motors, Inc., consists of four variable speed heads, two each for drilling and tapping. The automatic machine drills and taps 26 holes in a casting in two minutes, rotating the part three times during the cycle. See Plant Tour #14.

Ladies' Activities

Hospitality room and lounge will be maintained by wives of the Los Angeles host committee in Conference Room 2 of the Biltmore Hotel.

Registration for the Convention (no charge) at the ASTE registration area Conference Rooms 3 and 4 in the Biltmore.

Monday — *2-4 p.m.*

Get-acquainted tea. Galeria Room, Biltmore. No charge. Limit 100.

Tuesday — *9:30 a.m. to 4:30 p.m.*

Arboretum tour. Also visit to the Huntington Library and Museum, lunch at the Merry Mallard. Tickets $3.75 each. Limit 100.

Wednesday — *12:30 p.m. to 4 p.m.*

Sight-seeing. Tour of Hollywood, Beverly Hills and beach. No luncheon stop. Tickets $3.25 each. Limit 100.

Thursday — *10 a.m. to 2:30 p.m.*

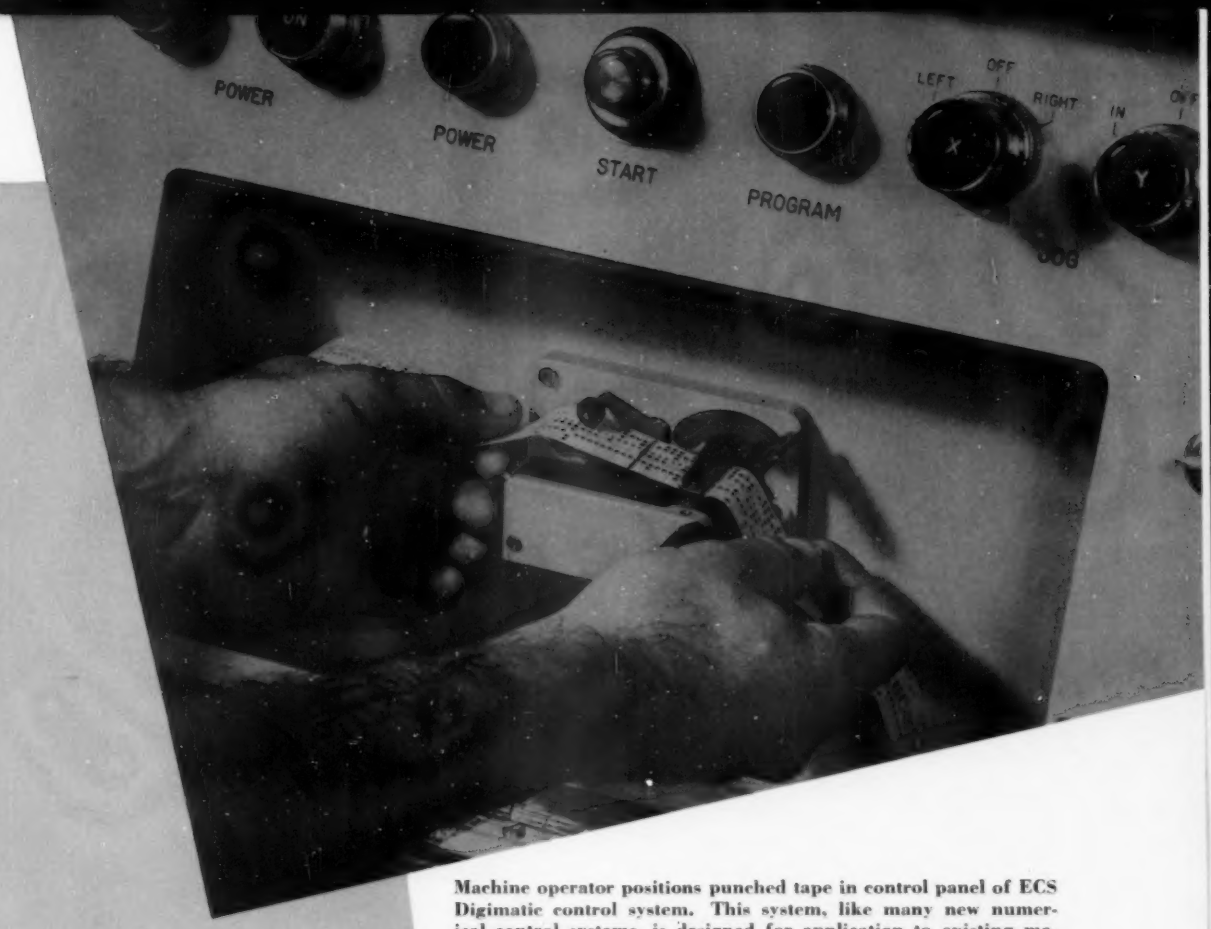
Farmers Market. Transportation tickets, $1.25 each. Limit 100.

Friday — *9 a.m. to 4:30 p.m.*

Marineland. Stop at Wayfarer's Chapel. Cost of luncheon not included in $4.50 per person charge for transportation and admission. Limit 100.

Saturday — *10 a.m. to 4:30 p.m.*

Disneyland. Postconvention trip for the whole family. Cost includes admission, 15 rides and a meal. Tickets $5.60 per person. Transportation extra.

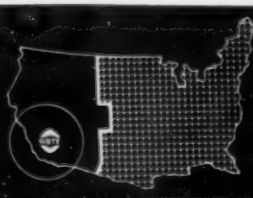


Machine operator positions punched tape in control panel of ECS Digimatic control system. This system, like many new numerical control systems, is designed for application to existing machines. It symbolizes the trend toward automatic operation for optimum production.

1958 Western TOOL SHOW

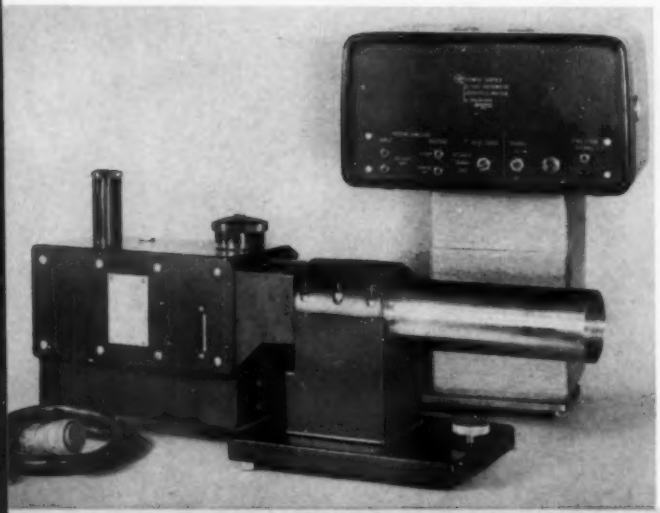
Some of the outstanding machines and tools exhibited at the Western Tool Show at Los Angeles are pictured on the following pages. This presentation is representative of the hundreds of exhibits at the Show itself—a galaxy of machines, tools and equipment designed to fill the need for tooling that is faster—more automatic—better built. Cost and quality-conscious executives and engineers will find that the Show is the best possible place to see—often in action—tooling that leads to profits in today's competitive economy and success in tomorrow's manufacturing ventures. Exhibits at the Show fully exemplify the precision, productivity and versatility of "Tooling for the Space Age." A complete alphabetical list of exhibitors begins on page 151.

- Products exhibited 138
- Floor plan of show 150
- Exhibitors' list 151

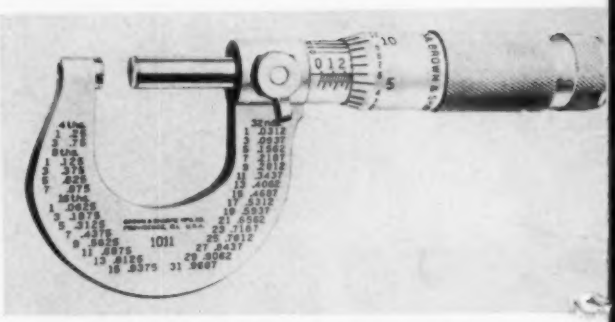


measurement

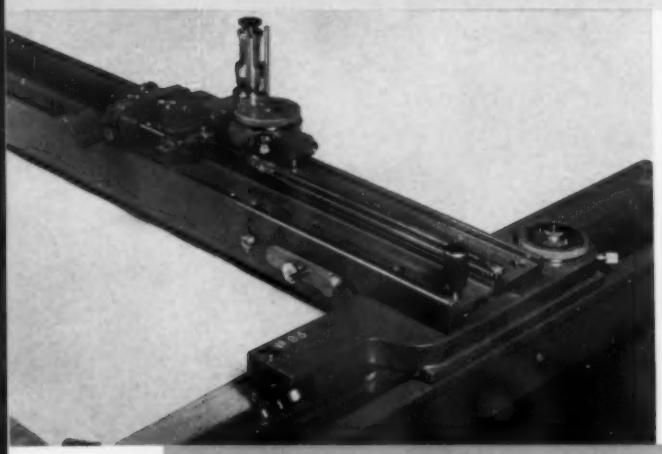
Industry requirements for versatility, accuracy in measurement and simplicity of operation are met by a host of precision instruments.



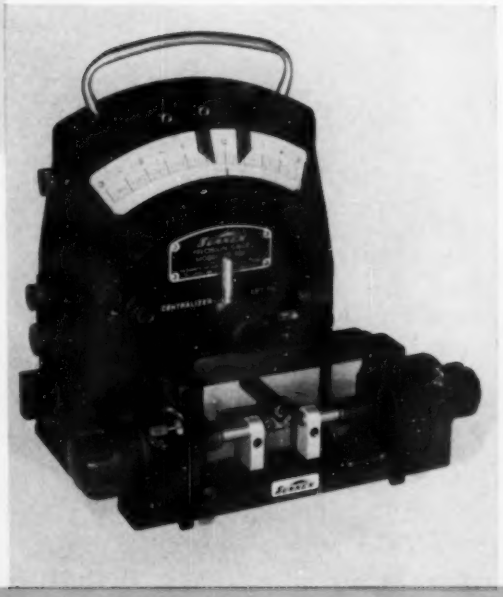
Provisions are made for directly transferring angular information from the instrument to recorders, relays, meters or amplifiers in this autocollimator manufactured by Davidson Mfg. Co. For applications where readings are required at intervals over a period of time, the information can be recorded automatically.



Brown & Sharpe micrometer can be used as a friction or fixed gage as the user desires. Changeover is made by means of a floating-lever lock. Graduations are on an angle for easier reading.



Aero Service Corp. coordinatograph features micrometer type screws for fine adjustments of both *X* and *Y* positions. Plotter rails pivot for angular displacement with reference to the drawing board.

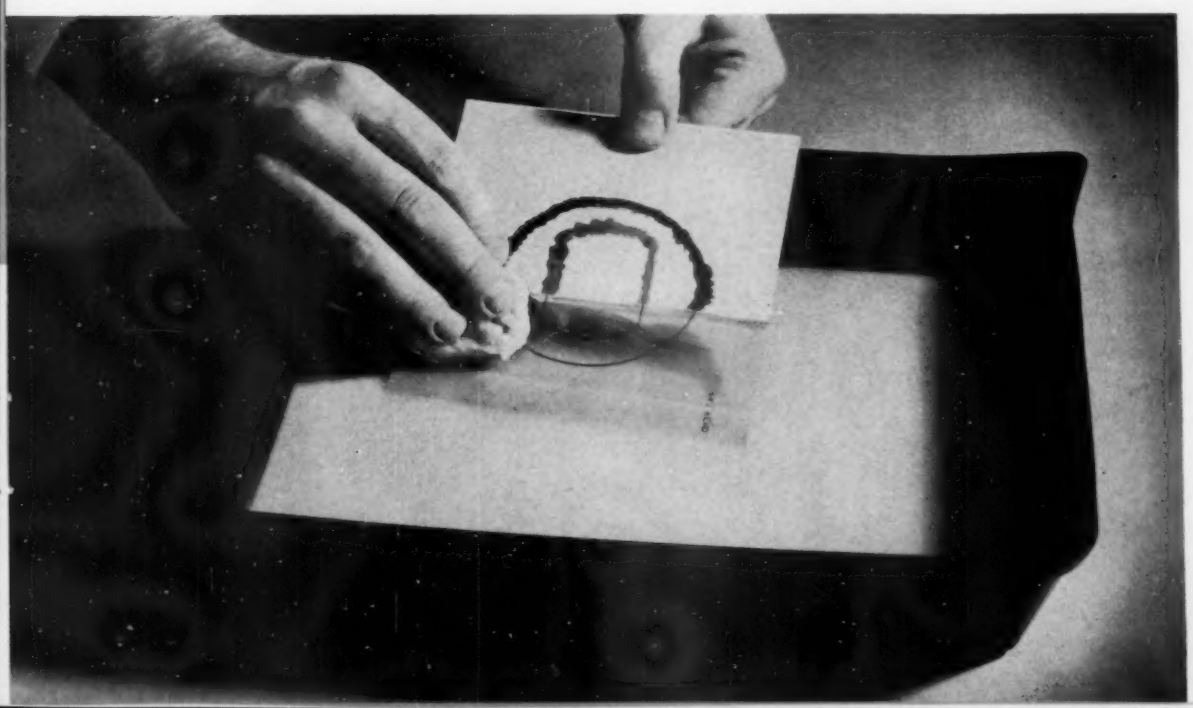


Combining a precision gage and setting fixture, Sunnen Service Corp. system makes internal measurements without ring gages, gage blocks or other standards. Size range is from ⅜ to 1½ inches.

Sherr-Tumico Super-Comparit reads directly in twenty-millionths of an inch. Cable release is provided for lifting the feeler point.

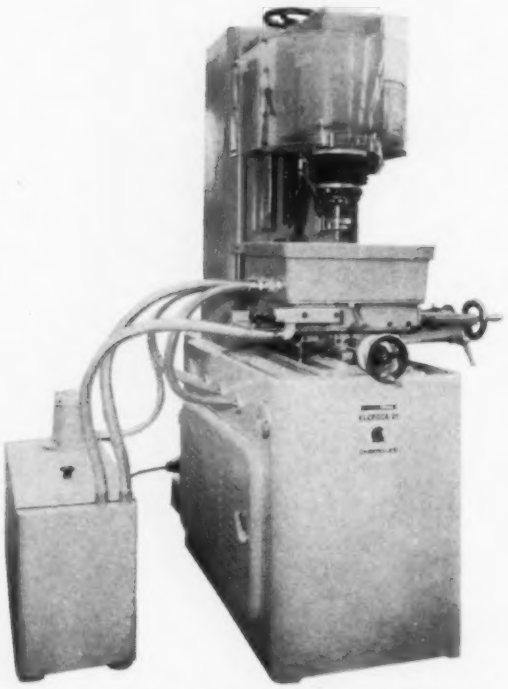
Hite-Icator (left) has a sensitive dial indicator that is actuated by the gage-block column itself, as it moves up and down over the one-inch range of the micrometer head. Hite-Chek (right) for transferring settings is available as a self-contained transistorized unit. Both units by Brown and Sharpe.

Chart-gages are prepared on coated plastic material made by Optical Gaging Products Inc., by scribing the desired layout using elementary layout tools or scribing equipment. The scribed lines are then brushed over with a special dye-like fluid. After dipping in a wash to remove excess fluid and the scribe coating, the chart is wiped dry with a cloth or sponge and is ready for use. Paul B. Slater.



cost cutting tools

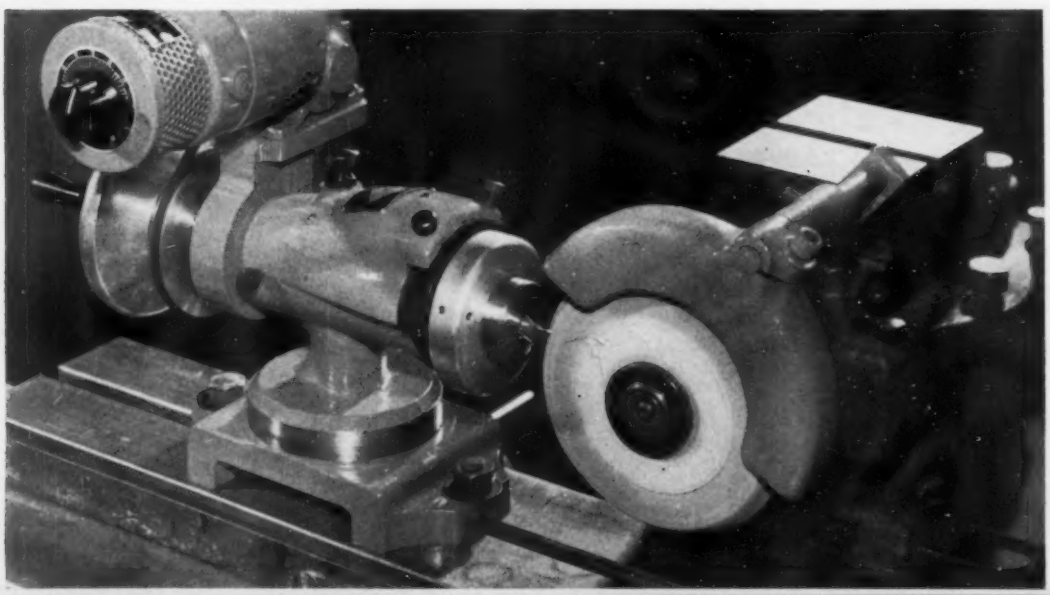
Diversity of the products of the tooling industry is exemplified by a number of versatile machines and tools—each capable of high productivity, each tailored for specific types of applications.

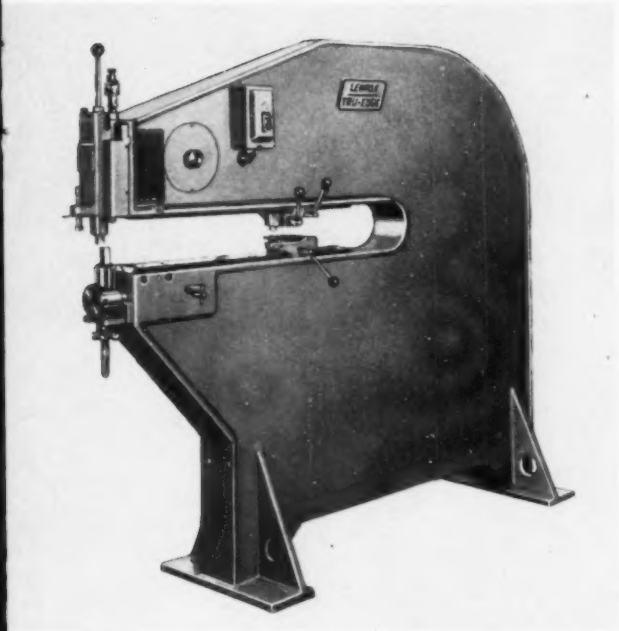


Electroerosion machine built by Charmilles Engineering Works Ltd. has simple controls and automatic downfeed and depth control. Machine can cut materials of any hardness and is intended for mold and die work.

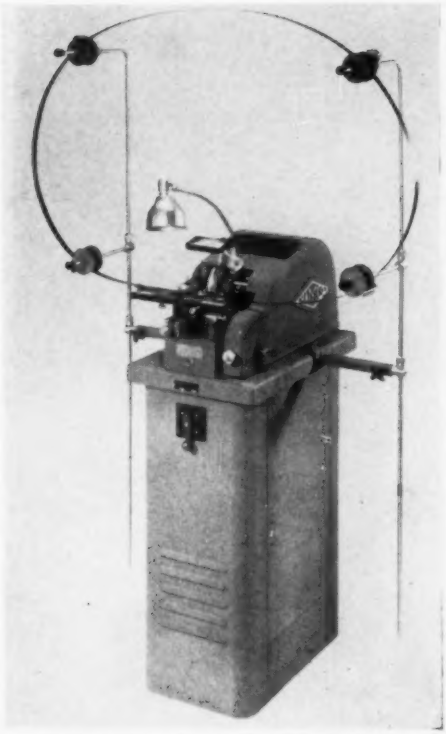
Jemco form and punch shaper is used to produce contour punches with curved necks, die sections and formed cylindrical contours. The work is completed in one chucking. For machining small precise parts, a measuring microscope is used to permit accurate centering, aligning and measuring.

Relief grinding fixture manufactured by Steptool Corp. is used for grinding helixpoints and other special shapes on twist drills. Fixture can be used with any surface grinder.



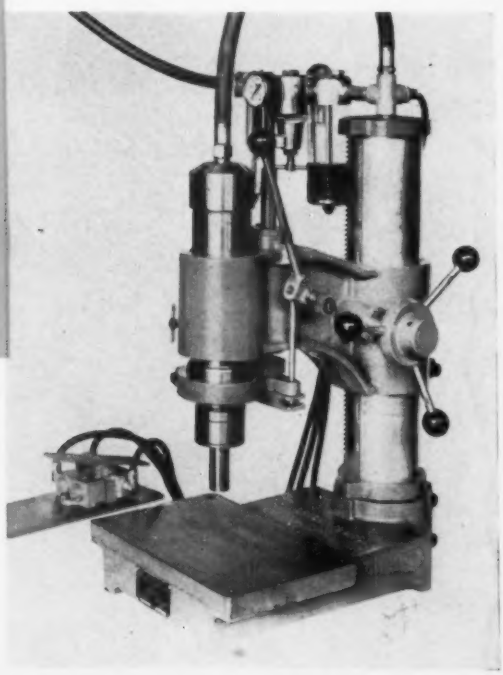


Lennox Tool and Machine Builders metal-cutting and forming machine has "vibrationless" operation. The stroke is set with a hand knob and machine has adjustable gibs for best cut on any diameter or thickness of material up to capacity.



Saw sharpener built by Hameo Machines, Inc. is three machines in one. Unit sharpens circular, band or hack saws. Only a few minutes is required to convert from one operation to another. Operation is automatic after setup.

Offset printer provides continuous printing on steel, aluminum or plastic pipe, bars, tubing or similar products. A rubber printing roll conforms to the contour of material being marked. Printing speeds are as high as 1000 fpm. Printer is manufactured by Jas. H. Matthews & Co.

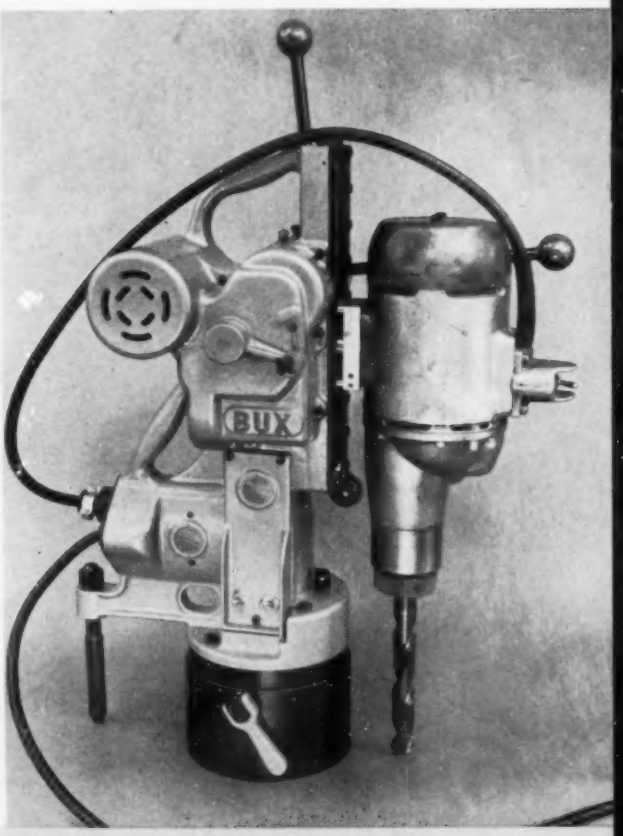


Repeating air hammer can be used for stamping, staking, swaging, riveting, crimping and similar operations. Valving arrangements permits operation with air pressures as low as 20 psi. An air traverse mechanism returns the hammer cylinder up from the work. The hammer is made by Heidrich-Nourse Co.

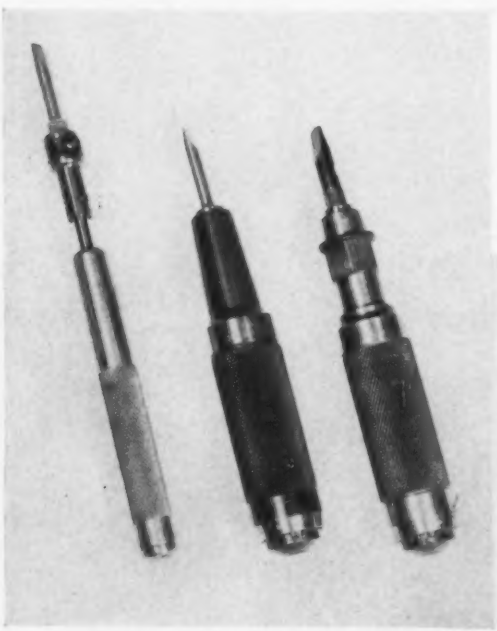
portable tools

Today's portable power tools are characterized by light weight, compactness, easy handling and high power-to-weight ratios; making them invaluable aids to productivity in thousands of plants.

Winslow Shavematic is fastened to the work by means of vacuum foot and mills off protruding rivets leaving a smooth finish. This portable tool is pneumatically operated. Rubber vacuum cup eliminates marred work.



Buck Mfg. Co. portable drill press has positive feed and two-speed control. All makes and sizes of portable drills can be adapted to the unit, which is capable of drilling holes up to 1¾-inch in diameter in any position.

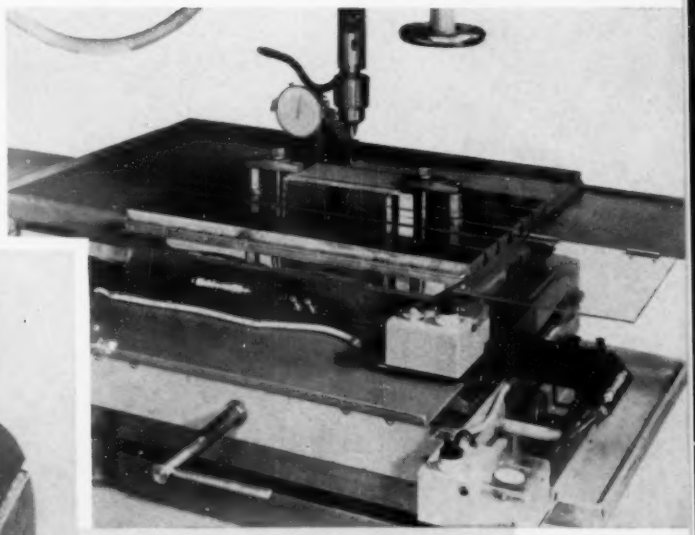


Safe-Torque screw drivers provide accurate torque control. They are used for tightening critical threaded fasteners in instrument assembly and similar work where air or electric powered tools cannot be used. The drivers, which operate on an overriding roller principle, are made by Scully-Jones.

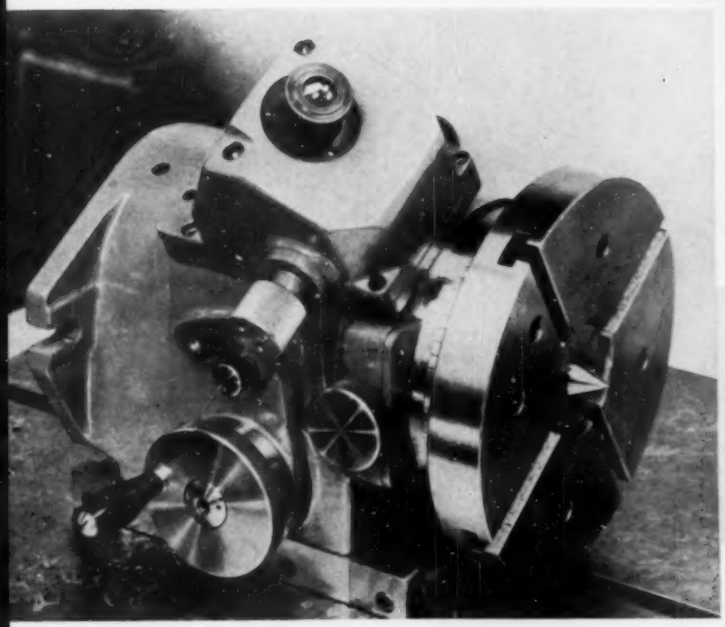
work positioners

Versatility, speed and accuracy are the advantages offered by up-to-date positioning tables and dividing heads.

Cross-slide rotary table for use with vertical milling machines. Table utilizes a principle of fast positioning eliminating the need for moving and relocating workpiece for different operations. An indexing attachment and a universal template and model-holding table are optional accessories designed to increase versatility. Made by Advance Products Corp.



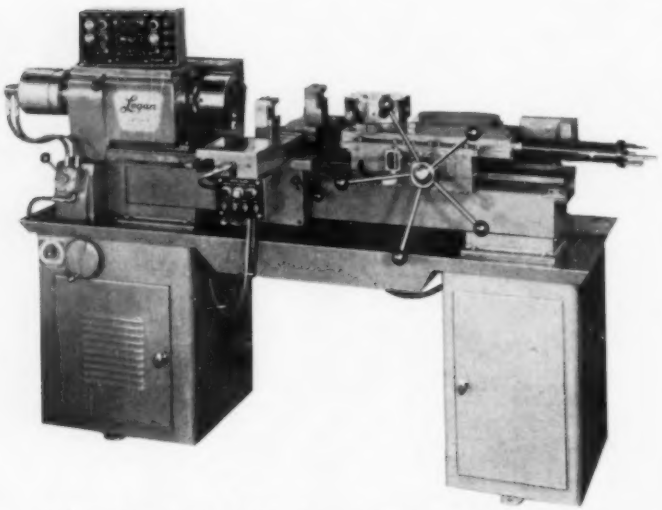
Automatic positioning spacer table aids in long or short run drilling, tapping or boring. Locations can be established by any of a wide variety of methods. First piece or toolroom work can be done by using gage blocks or end measures and micrometers. Table is made by Industrial East Co.



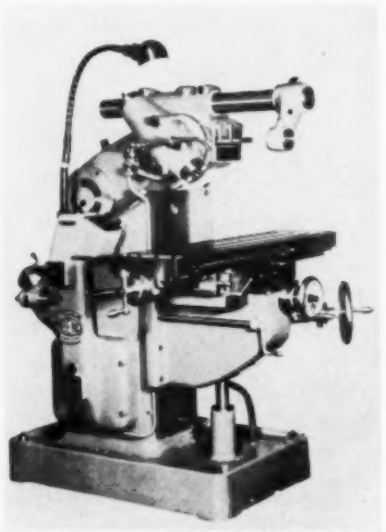
Optical dividing head by Sherr-Tumico Co. reads directly to two seconds of an arc. The optical reading feature speeds use and gives exceptional accuracy.

metal cutting and grinding machines

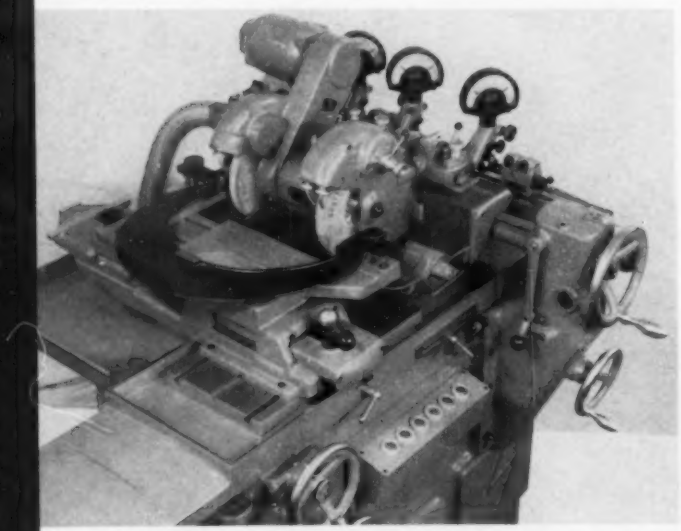
Accuracy, dependability, versatility, automation and speed of production are featured in new machine tool designs. Builders are following a major trend in industrial production—higher production with less operator attention.



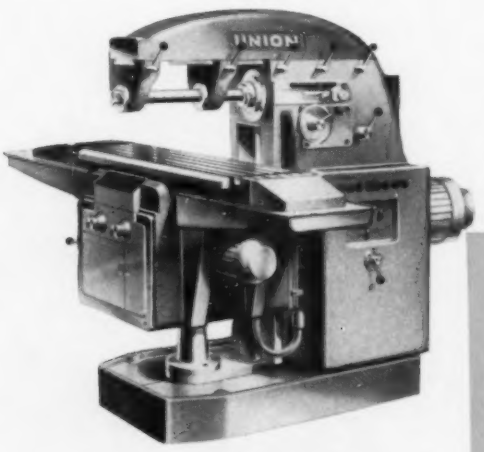
Independent front and rear cross slides are powered by an air-hydraulic system on this Logan Engineering Co. automated turret lathe. The turret cycles through successive stations automatically. A control drum provides for stopping the turret at any of the six stations for cross slide operations and for unloading the finished part. The stroke length and rapid travel stroke length are independently adjustable for each of the turret stations.



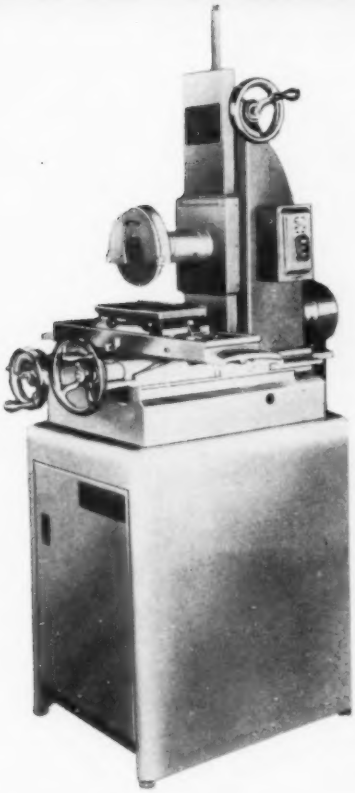
Abene VHF-2B milling machine combines the working scope of vertical and horizontal millers. The spindle can be placed at right angles to the longitudinal line of the table and is adjustable from zero degrees in the horizontal plane to 45 degrees over the vertical plane. Aaron Machinery Co., Inc.



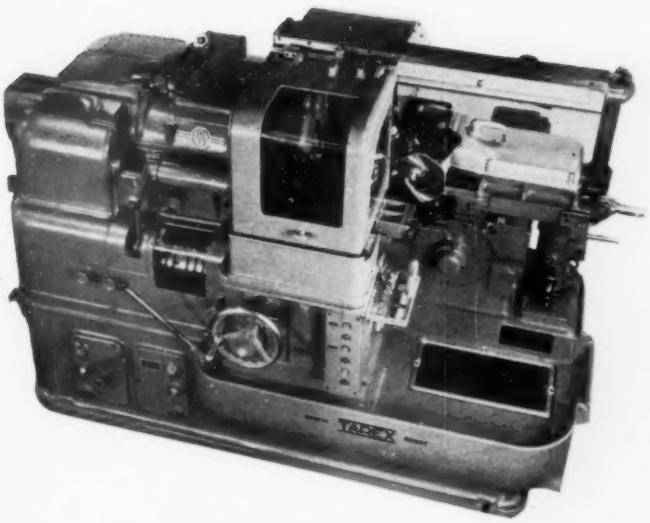
Plane parallel grinding machine manufactured by Schultz-Hermsdorf features continuous size indication The repeating size on parts subsequent to the first is independent of wheel wear. The machine is extensively used for grinding gap gages. Mercuria Co.



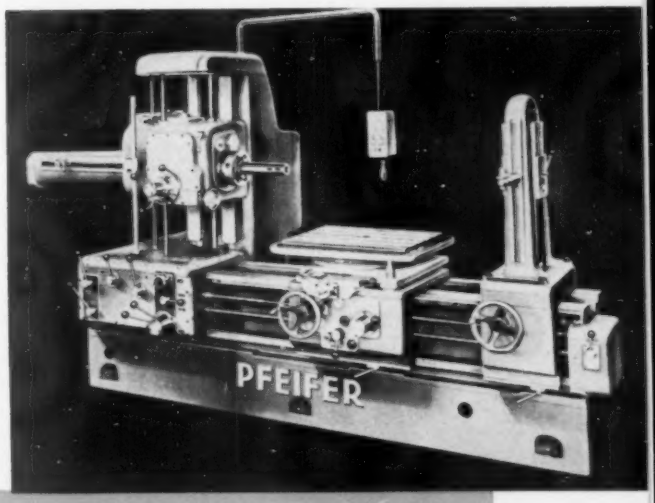
A climb milling attachment enables this Union milling machine (Mercuria Co.) to accomplish planetary milling operations. The machine also features rapid automatic power return movement.



Surface grinder manufactured by Harig Mfg. Co. features angular rack and pinion, centrally mounted elevating screw, combination V and flat ways. Motorized spindle, dust collector and water unit are optional. Bell Machinery Co., Inc.



Tarex automatic turret lathe (Russel, Holbrook & Henderson, Inc.) has compound front and rear slides that have longitudinal as well as transverse motion. Available in an electronically controlled machine which provides as many as eight spindle speeds during a cycle and a constant surface speed feature for facing operations.

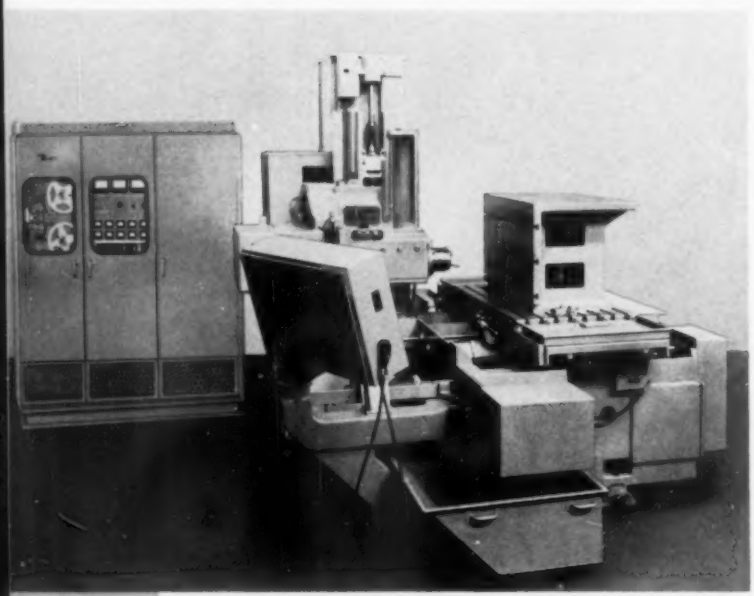


Using design principles employed in lathe construction, this Pfeifer boring mill is made with the spindle head at the left of the bed. Operational controls are centrally located to have them within easy reach of the operator. Aaron Machinery Co.

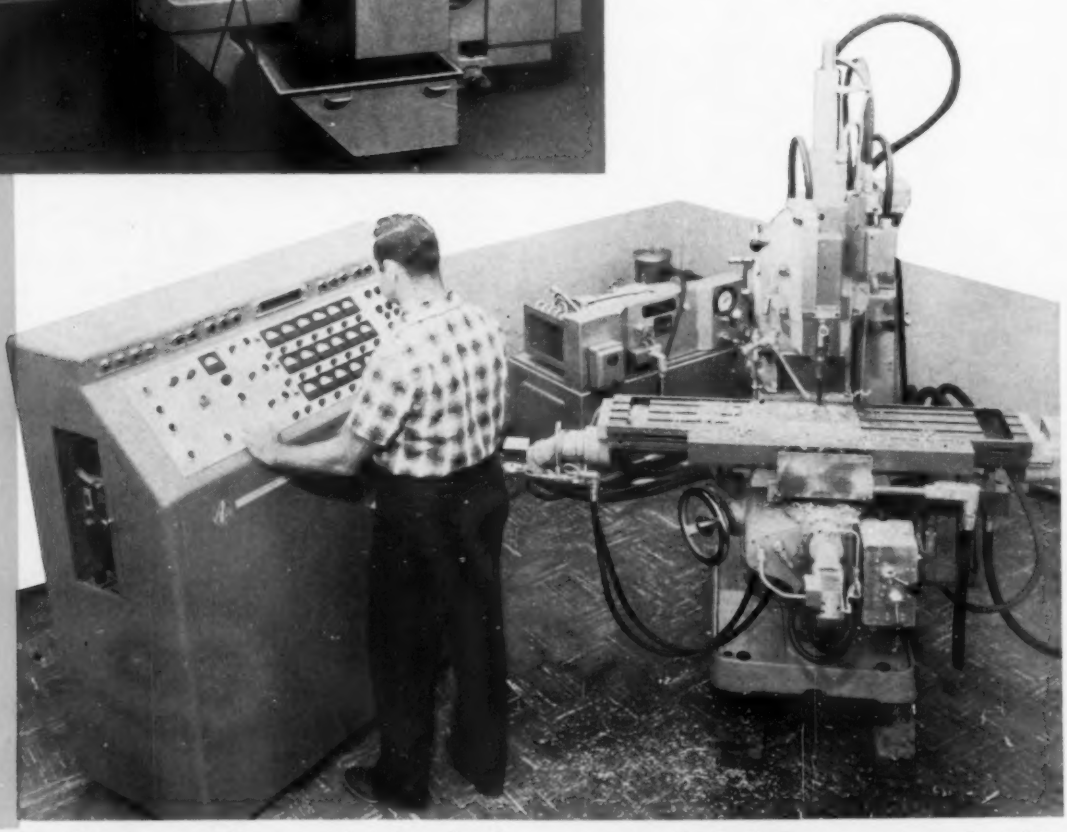
Boyar-Schultz 6-18 surface grinder is equipped with either hydraulic longitudinal feed or hand feed.

numerical control

Late-model numerical systems are capable of controlling complex three-dimensional contouring machines or simple positioning operations as in drilling. These systems cut lead time, machine time and costs.



Bendix numerical control system is especially suited for producing complex three dimensional parts such as turbine blades, cams, molds, forging dies, aircraft integral skin panels, spars and forged fittings. Bendix also includes computers and tape preparation equipment to supplement the system.



Numill accepts tape data in number form directly from general purpose digital computers. The console converts data from the control tape into a series of command impulses, each of which calls for a machine movement of 0.0002 inch. Linear-electro-optical gages provide feedback measurements of machine movements. Machine movements are compared to command orders to insure tape orders are carried out. The system, built by Autonetics Div. of North American Aviation, uses transistorized circuitry.

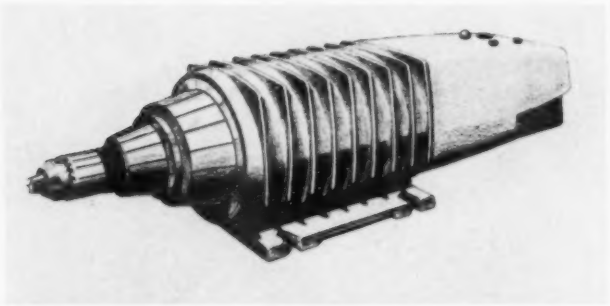
Electronic Control Systems Digimatic 180 control system operating a contour milling machine. This unit is for heavy duty machine tool operations and uses magnetic tape. Two other Digamatic systems provide control for everyday machine shop operations and for point positioning applications. The point positioning system uses standard one-inch paper tape. Contour control systems cut true circles for greater accuracy and smooth finish.

A package unit built by General Electric operates from data stored in standard eight-channel punched tape or manually set decade switches. Positioning speeds of 200 ipm can be obtained with ± 0.0005-inch repeatable accuracy. The control provides for individual or simultaneous linear and rotary positioning with accuracy of ± 0.0005 inch at 99.99 ipm.

The Probomat is an electromechanical system and uses electronics only to a limited extent. It is made in two types: for control of leadscrews and worms, and for control of slides and rotaries independent of leadscrews. Warner & Swasey Research Corp., the manufacturers, offer equipment to be installed in the field or to be built into new machines.

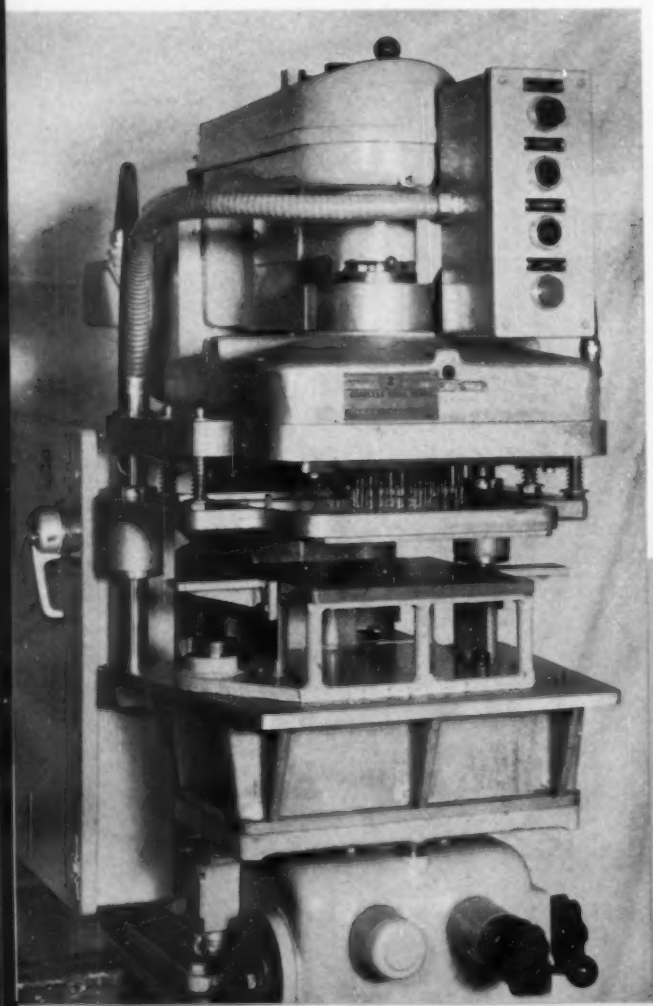
drilling and tapping

Modern drilling and tapping machines and accessories exemplify the trend toward improved accuracy, greater productivity and better tool life.



Ekwall Corp. automatic drill head combines head and motor into one unit. The motor shaft serves as the spindle support and actuator. Unit is specifically designed for use in automatic processing systems.

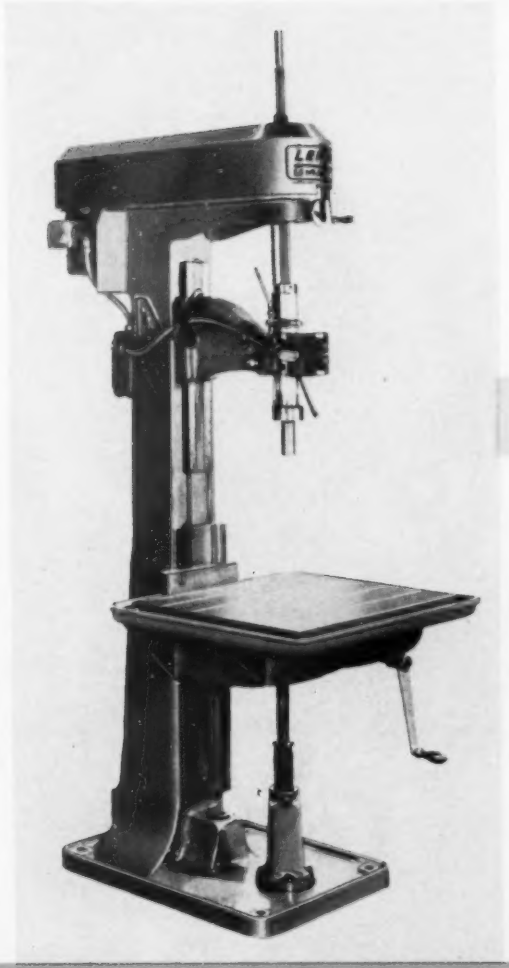
Sealol chip ejector and coolant applicator is designed for longer tap life, better size control, smoother and more accurate threads. Unit fastens to the tap with a setscrew. Coolant is forced down flutes, flushing chips out.



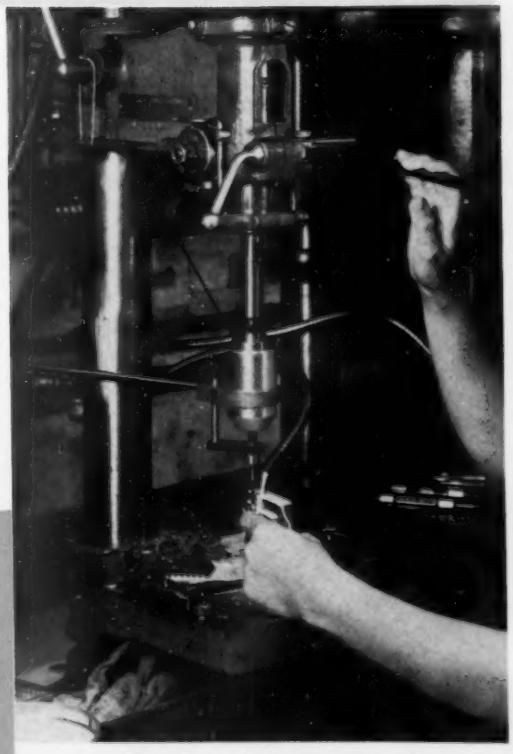
Wales Strippit Flex-O-Drill produces templates accurately with micrometric gages. The machine has a ¼-inch chuck and can be used for drilling, reaming, scribing and center punching. Capacity is 24 by 24 inches by ¼ inch.

Using a conventional head machined to accommodate an insert, this Zagar Tool, Inc. machine drills up to 1100 holes in printed circuits. The insert consists of an oscillator driving plate, upper and lower bottom plates, spacer and spindles. Spindles are located to conform to the specifications of the circuit. Separate inserts are constructed for each circuit.

Boyar-Schultz leadscrew tapping machine has foot pedal control automatic tapping cycle leaving operator's hands free for handling work or fixtures.

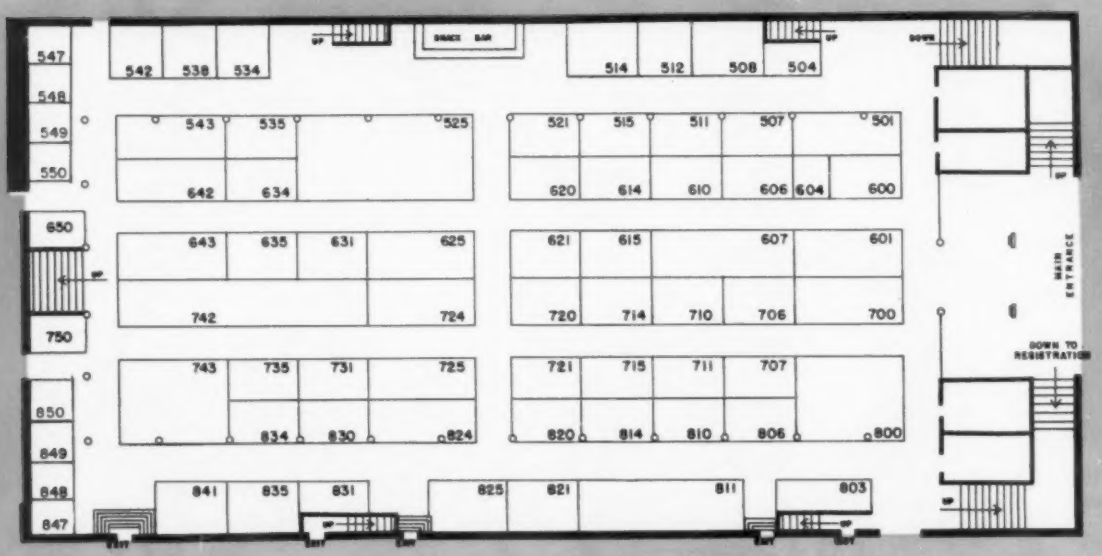


Spindle of Lennox-Demco drilling machine automatically compensates for wear. All wear takes place on ball bearings housed in a dust-proof quill. Bearings are held in position by a spring on the spindle shaft which exerts pressure on the inner race. The lower bearing is an annular thrust type with a conical race. The upward pressure of the spindle caused by the spring centers the spindle and eliminates side motion. The spindle is fitted with removable feed rack and steel pinion. Power feed with back gears is available. Machine is made by Lennox Tool & Machine Builders.

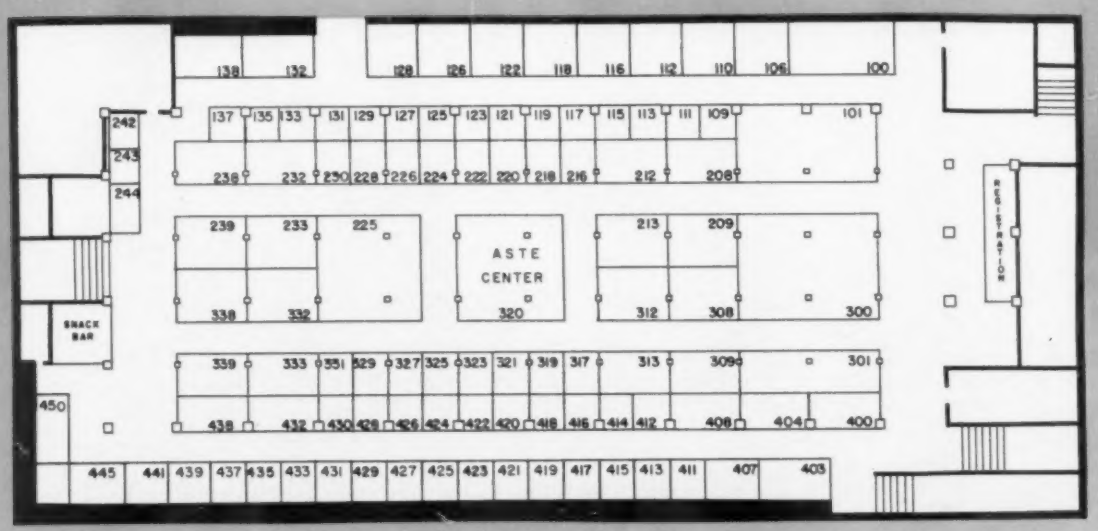


Tap driver by Scully-Jones has overload clutch which releases when torque exceeds setting. After release, driver is freewheeling.

1958 Western Tool Show



GROUND LEVEL



LOWER LEVEL

• Floor Plan
• Exhibitors' List

SHRINE EXPOSITION HALL
LOS ANGELES, CALIFORNIA
SEPTEMBER 29—OCTOBER 3, 1958

	Booth No.
Aaron Machinery Co., Inc.	800
Accu Rite Surface Plate Co.	113
Ace Drill Bushing Co., Inc.	831
Advance Products Corp.	504
Aero Service Corp.	415
Alameda Gage Co.	413
Alexander Machinery Co., Inc.	742
Allied Engineering Production Corp.	232
– Am –	
American Drill Bushing Co.	625
American Herforder Co.	404
American Pullmax Co., Inc.	615
Apprenticeship Tool Designer	848
Arrowsmith Tool & Die Corp.	825
Atom Wheel Tool Co.	433
Atrax Co., The	820
Automat Machine Co.	226
Autonetics Div., North American Aviation, Inc.	710
– B –	
Bea-Mac Tool Service	111
Bell Machinery Co., Inc.	607
Bendix Aviation Corp., Controls Section	225
Bentley Industrial Corp.	100
Besly-Welles Corp.	308
Boggis, Henry P., & Co.	109
Boyar-Schultz Corp.	535
Brown & Sharpe Mfg. Co.	824
Buck Mfg. Co.	131
– C –	
California Broach Co.	429
California State Polytechnic College	233
Canadian Government Exhibition Commission	811
Carr Lane Mfg. Co.	407
Carter Controls, Inc.	610
Cazeneuve Sales Co.	635
Charmilles Engineering Works Ltd.	715
Collins Machinery Corp.	707
Collins Microflat Co.	417
Crawford, M. C., Co.	123
– D –	
Danly Machine Specialities, Inc.	601
Davidson Mfg. Co.	419
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co.	803
Dayton Perforators, Inc.	833
De Castro, O. F., & Associates	700

This list of exhibitors for the ASTE 1958 Western Tool Show is complete and accurate as of press time. We hope the listing will help visitors plan their show itineraries.

	Booth No.
Detroit Stamping Co.	501
Devcon Corp.	110
Diamond Machine Tool Corp.	841
Dillon Stevens & Co.	421
– E –	
Ekwall Corp.	325
Electronic Controls Systems	814
Electrosystems Inc.	439
Encyclopedia Britannica	242
Engis Equipment Co.	724
Equipment & Materials Reporter	431
– F - G –	
Fenway Machine Co.	422
Foster, C. E., Gage Corp.	301
Furane Plastics, Inc.	411
Gebhart Engineering & Mfg. Co.	423
General American Transportation Corp.	321

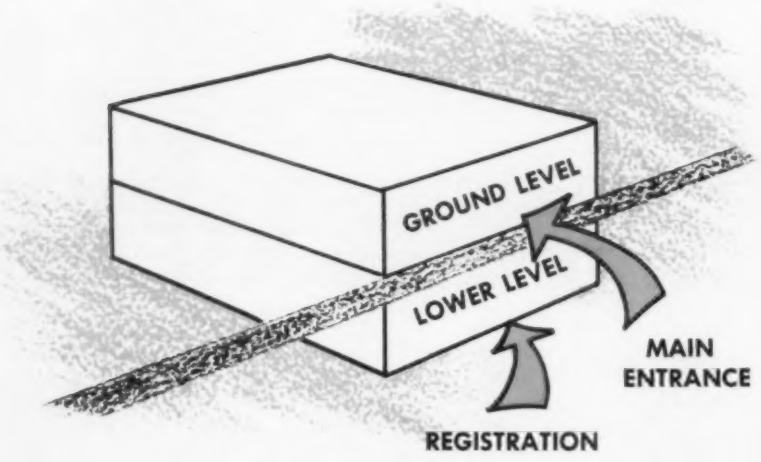
	Booth No.
General Electric Co.	118
General Fire Extinguisher Corp., The	121
Great Books of the Western World	418

– H –

Hamco Machines Inc.	420
Hanson-Whitney Co.	821
Harvel Co.	127
Hed-Wick & Co.	642
Heidrich-Nourse Co.	220
Heinze, A. G., Co.	403
Heller Tool Co.	445
Homestrand Inc.	806
Hyge Machines-Convair	208

– I - K –

Imperial Tool Co.	135
Industrial East Co.	408
Industrial News	129
Industrial Press, The	412
Instrumentation Sales	243



Jamison Steel Corp.	731
Jarvis Corp.	720
Keuffel & Esser Co.	515

– L –

Lee, K. O., Co.	634
Lennox Tool and Machine Bldrs.	327
Leonard Precision Products Co.	543
Levin, Louis, & Son, Inc.	714
Livernois Engineering Co.	711
Long Beach City College	209
Los Angeles City College	847
Los Angeles Harbor Jr. College	847
Loy, Frank, & Associates	521

	Booth No.

– M –

Machinery Sales Co.	534
Madison-Faessler Co.	331
Man-Au-Cycle Corp. of America	300
Marine Pumps Inc., Div. Diesel Control	414
Marshall Tool & Supply Corp.	508
Matthews, Jas. H., & Co.	212
Mayhew Products Co.	218
Mercuria Co.	338
Metal Removal Co., The	400
Meyer Sheet Metal Machinery Co.	743
Motch & Merryweather Machinery Co.	830
Mount San Antonio College	850

– N - O –

Nardon Mfg. Co.	549
National Pioneer Sales & Service	132
New Hermes Engraving Machine Corp.	430
North American Viking Drill Co.	650
Northwestern Tools, Inc.	424
Numatic Engineering	604
Nupla Mfg. Co. Div., New Plastic Corp.	514
Oakite Products, Inc.	735
Olivetti Corp. of America	106

– P - Q –

PIC Design Corp.	125
Pailey Supply Co.	332
Pasadena City College	116
Pathex (Canada) Ltd.	239
Peck-Lewis Corp.	115
Pierce Jr. College	847
Pioneer Aluminum, Inc.	706
Pioneer Broach Co.	117
Portage Double-Quick, Inc.	643
Porter Precision Products	725
Precision Tool Sales	101
Quackenbush, A. B., Co.	238

– R –

Ready Tool Co.	428
Reliance Magnesium Co.	507
Revco Inc.	437
Russell, Holbrook & Henderson, Inc.	525

– S –

S & S Machinery Co.	300
Sandvik Steel, Inc.	244
Santa Monica City College	849
Scherr-Tumico Co.	450
Scully-Jones & Co.	620
Sealol Corp.	224
Service Machine Co.	432
Sheffield Western Corp.	333
Sheridan Advertising	416
Siewek Tool Co.	441
Sigma Machinery Inc.	631
Simonds Abrasive Co.	721
Simonds Saw and Steel Co.	721
Skil Corp.	542
Slater, Paul B., Co.	511
Starrett, L. S., Co., The	606
Steco Corp., The	228
Steptool Corp.	133
Sunnen Products Co.	230
Supreme Products Corp.	329
Syntron Co.	216

– T –

Techno-Products Corp.	501
Termite Drills, Inc.	319
Tocco Div., Ohio Crankshaft Co., The	614
Tool Specialty Co.	750
Topp Industries Div., Topp Mfg. Corp.	810
True-Trace Sales Corp.	600

– V - Z –

Veet Industries	408
Vlier Engineering, Inc.	512
Waldes Kohinoor, Inc.	323
Wales-Strippit Co.	621
Wesrep Corp.	137
West Point Mfg. Co.	317
Western Machinery & Steel World	426
Western Metalworking	435
Western Saw Mfrs., Inc.	122
Winslow Product Engineering Corp.	222
Zagar, Inc.	438
Zeiss, Carl, Inc.	834

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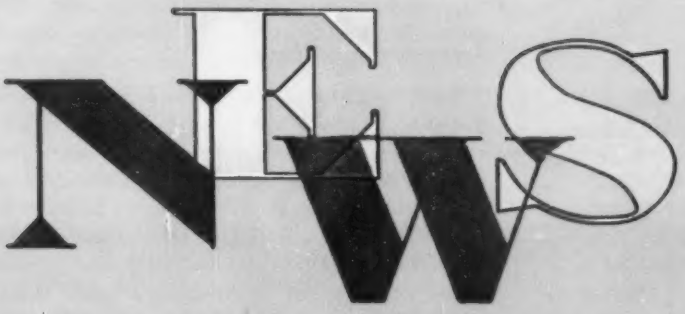


ASTE comes to Pennsylvania Capital

DISTINCTION was the keynote for the Keystone State of Pennsylvania on June 30, 1958, when the capital city was host for the chartering of Greater Harrisburg Chapter No. 149.

Significant in the annals of the American Society of Tool Engineers, Chapter No. 149 has distinguished itself in a variety of ways. A mere 11 weeks before the chartering, the first organizational meeting, arranged by Messrs. Goldbach, Lierse, Belsak, Donmoyer, Troutman, and Etsweiler, was held on April 9, 1958. This meeting had hopes of gathering some 30 people; instead, 83 attended. Present were Chairman Carl Darger and John Webster of the national membership committee. They gave such an excellent dissertation on the how, who, why, where and when of the Society that 97 percent of those people are members today. From the initial meeting to the June 30 chartering day, the chapter received 38 transfers of members from two neighboring chapters, 182 combined senior, junior and associate member applications with monies, plus two affiliate memberships.

Those members nominated and elected: as chairman, William H. Goldbach, manager of industrial engineering, Thompson Products, Inc., Harrisburg Works; first vice chairman, Jesse W. Elliot, vice president of manufacturing, Brubaker Tool Corp.; second vice chairman, Anthony L. Belsak, administrative engineer, also of Thompson Products; secretary, Lamar F. Moore, senior engineer, Olmsted Air Force Base; and treasurer, James E. Lynch, tool designer, AMP, Inc.

National President George A. Goodwin presided over the chartering ceremony, presenting the chapter charter to Chairman Goldbach. The chairman's lapel emblem was pinned on by National Vice President David A. Schrom. The membership kit was presented to Membership Committee Chairman Roy N. Donmoyer, by National Membership Chairman Carl Darger. The "newest chapter token" was presented by Marvin J. Bunting, staff administrator for membership, and a dues apportionment check by John Webster, regional membership chairman.

Toastmaster for the meeting was Past President Harry (Doc) Osborne, Jr., and the main speaker, James Low, of the National Association of Manufacturers speakers' staff, whose talk was on "Your Most Important Tool, Leadership." Local dignitaries attending were Harrisburg's mayor, Nolan F. Ziegler, and the president of the Harrisburg Chamber of Commerce, Wallace H. Alexander, who promised wholehearted cooperation in any of the new chapter's endeavors.

Representative Industries

Harrisburg's membership stems from such diverse industries as missile and jet engine manufacturing; electronic fastening devices and machinery for same; a major Air Force field and maintenance depot; cutting tool manufacturers; in addition to one of the nation's largest steel manufacturers (Bethlehem Steel Co.); another steel manufacturer (Harsco Corp.); one of the nation's largest aluminum products fabricators (Capitol Products); electronic crystal manufacturers; American Can Co.; and numerous tool and die shops, machinery and industrial suppliers and distributors.

Charter officers of the Greater Harrisburg chapter taking the oath are (from left): W. H. Goldbach, chairman; J. W. Elliot, first vice chairman; S. L. Belsak, second vice chairman; L. F. Moore, secretary; J. E. Lynch, treasurer. Seated at the head table are Speaker James Low, Toastmaster Harry B. Osborn, Jr., past president of ASTE, and Harrisburg's mayor, Norman F. Ziegler.

In the state of Pennsylvania which has 11 other chapters, this chapter numbers third in the size of membership, also having one of the largest memberships at time of chartering.

Age of the members ranges from that of students to an eighty-year-old semiretired senior member with a background in active tool engineering dating back to his apprenticeship days during the "gay nineties" at the Pennsylvania Steel Co., which today is the Bethlehem Steel Co.

About the City of Harrisburg . . .

Harrisburg is the practical axis of the Pennsylvania Turnpike with four interchanges at convenient points, a larger number than any other city near this superhighway. Truckwise, 28 carriers are certificated to operate to almost all points. The city has ten numbered highways, a greater density than any city in the East. Three airlines, TWA, Capital and Allegheny, serve the Harrisburg Airport.

Harrisburg's economy is diversified in an unusual manner. Approximately 25 percent of its payrolls comes from State Capitol and other state agencies, 25 percent from defense posts located in the immediate vicinity, 25 percent from industries, and 25 percent from wholesale and service trades. The end result is that when there is a dip in the business cycle, Harrisburg is less affected than communities with single industry support. As evidence, bank clearings are running ahead of 1957 and bankers predict that this year they will exceed one-half billion dollars.

The greater metropolitan area of Harrisburg, comprising all of Dauphin and Cumberland counties, boasts a population of roughly 330,000, making it the fifth-ranking of such areas in the state. The largest segment of its working populace, 39,000 people, is employed in some 492 manufacturing plants; 18,000 at defense depots; 15,000 by the Commonwealth; 7000 each by railroads and in wholesale trades; 5000 in service establishments; and 3000 in insurance headquarters.

The city proper ranks second in per capita income in the state, seventh in population, first in per capita retail sales, and third in conventions. Its retail sales are running close to $202 million in 1958, according to sales management estimates.

With such figures to back him up, Chairman Goldbach of the new Harrisburg ASTE unit predicts even greater eminence to the area's industry with the formation of his chapter. Thus far the group has proven a number of points: that the large reservoir of engineering and technical people employed in the city will sustain and further swell the chapter's ranks; that there abounds a profound willingness among these people to organize and improve the stature of the tool engineering profession; and that there exists a determination on the part of the members to make their chapter grow and realize all the objectives for which the Society stands.

In the national spotlight

Society approves tool engineering curriculum

A SUGGESTED two-year curriculum in tool engineering has been given the official sanction of the American Society of Tool Engineers with the July 25 approval of the Society's national education committee. Although it is recognized that the proposed schedule of courses, long the subject of discussion by industrial educators both within and outside the circle of the Society, cannot presume to fit all situations, individuals, and institutions, it stands as a guide for the type of training needed to equip an individual for the increasingly prominent position of "tool engineer."

The over-all breakdown of the curriculum is as follows:

Technical		
Mathematics	12%	9 hours
Basic Sciences	16%	12 hours
Tool Engineering	52%	38 hours
Communications	8%	6 hours
General Education	9%	7 hours
Electives	3%	4 hours

Specific subjects falling under the largest category, Tool Engineering, are technical drafting and tool design, industrial materials and processes, machine tool processes, metal-cutting and forming, strength of materials, principles of tool engineering, industrial electricity, controls and circuits—both electronic and hydraulic, measurement and controls, process instrumentation and metallurgy.

Suggested electives are industrial psychology, time and motion study, industrial management, and industrial health and safety. General education courses, such as human relations, the citizen and his community, industrial economics, foundations of American life, and physical education, are aimed at striking a balance between technical and liberal education, and at encouraging a student's continued personal and educational development. Therefore, the word "terminal" does not seem appropriate in this two-year curriculum.

Printed copies of the curriculum schedule are being readied for distribution to chapter and national officials of ASTE, as well as to educational institutions for possible incorporation into their technical programs, according to Education Director Gilbert E. Seeley.

Professional Engineering Committee meets in New York

Vice Chairman Al Fairchild (standing) makes a point before other committeemen. From left are: George D'Angelo, vice chairman of Paterson chapter; William Moreland, ASTE vice president and committee ex officio; A. E. Downey, staff administrator; Vernon Gallichotte; Hugh Aglietti, committee chairman; George Julien; C. H. Thuman, vice chairman; Howard Gross, consulting member; and L. E. Doyle. At this meeting, held in New York on July 26, it was proposed to change the name of the committee to professional development to indicate more clearly the aim of the committee's efforts.

members in the NEWS

John E. Rotchford

John E. Rotchford, Worcester, chairman of the ASTE national standards committee, recently became tool and material standards supervisor, responsible for setting up and maintaining the standards department at Raytheon Mfg. Co. in Lowell, Mass.

H. Richard O'Hara, Jr., an employee of Buick Motor Div., General Motors Corp. for 16 years, was recently made superintendent of Buick Factory 5, in charge of Dynaflow machining and heat treatment. Mr. O'Hara, member of Saginaw Valley chapter, had been general assistant superintendent.

St. Clair J. Hayes, chairman of Ottawa Valley chapter, has been notified by the Association of Professional Engineers of Ontario, that he has been accepted for registration under the Professional Engineers Act of Ontario. Mr. Hayes is the senior scientific officer with the Canadian Government, presently serving as mechanical superintendent of the Mines Branch.

Grant Morrison

The Metallurgical Products Dept. of General Electric has named **Grant A. Morrison,** of the Detroit chapter, as manager of product design and application engineering. Mr. Morrison, formerly engineering administrator, will be responsible for design and application of carbide products—including dies, components, mining and cutting tools—for the machinability laboratory and drafting service. He joined GE in 1951 after tool sales work in Wichita, Tulsa, and Houston.

D. Thomas Noe

D. Thomas Noe, senior member of the Detroit ASTE chapter since 1942, has been elected president of the Michigan Society of Professional Engineers for the 1958-59 term. Mr. Noe has had extensive experience with the professional engineering society at both the chapter and state levels, has served on the board of directors of both the Michigan and national groups, and also in numerous committee assignments with the NSPE. Presently employed by Burroughs, he has also held positions with American Motors, Chrysler Corp., and General Motors Corp.

The promotion of three executives has been announced at The Sheffield Corp., a subsidiary of Bendix Aviation Corp. **Jack T. Welch** and **Victor J. Boll,** members of Dayton chapter, were appointed vice president in charge of field sales and assistant vice president of the Contract Manufacturing Div., respectively. **Thomas H. Clark,** Detroit, was named assistant vice president of the Service Facilities Div. He had previously served as general manager of the company's out-of-Dayton plants.

Glenn J. Hartung, Birmingham, has been appointed plant engineer at Robbins Floor Products, Inc. Prior to his association with Robbins, Mr. Hartung practiced the profession of industrial engineering and tool design engineering for a number of years. He has been responsible for a number of design improvements on machines producing various types of resilient floor covering, and since joining the Robbins organization he has been engaged in engineering and design work on many exclusive Robbins products.

Adolph O. Schaefer, Philadelphia, president of Pencoyd Steel & Forge Corp., has accepted appointment by the board of trustees of the American Society for Metals to the unexpired term of secretary of the society, following the recent death of William H. Eisenman, who had served in that capacity for 40 years.

Mr. Schaefer is a past president of the metals society and has been active as a national trustee and in the affairs of the Philadelphia chapter as secretary, treasurer and chairman of the local group.

Leslie F. Hawes

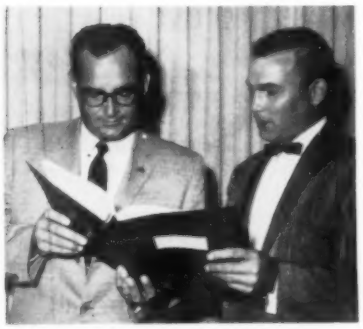
Leslie F. Hawes, Los Angeles, president of Southern California Metal Spinning Co., has been appointed operational manager of SPACE Corp., Garland, Texas. He has assumed supervision of the firm's engineering, procurement, manufacturing, quality control, and field service activities. Mr. Hawes is past chairman of the ASTE Los Angeles chapter. "In his affiliation with SPACE, Hawes joins a team of scientists, engineers, technicians, and managers that has taken a significant part during the past year alone in the success of the Boeing Bomarc, the Martin Titan, and Convair Atlas," President M. G. Hughett announced.

LONDON-ST. THOMAS—The entire executive group set a chapter precedent by visiting ASTE's Detroit headquarters en masse for a tour of the facilities and discussions with staff members on July 18. Here, Richard Gebers (left), public relations director, shows a staff-prepared pamphlet to London Vice Chairman Howard J. Wright and Public Relations Chairman Louis Jensen in one of the many informal discussion groups.

Chapter Makes Awards; Hears Satellite Lecture

Three $100 scholarships were awarded by Santa Ana Valley members to junior college students who will enter college this fall. Recipients are: Sei Furukalua, of Orange Coast Junior College; Alan Stewart of Fullerton Junior College; and Dave Burnett, also of Fullerton. All three will study engineering at UCLA.

Everett J. Urbach, head of the reports and presentations section for rocket projects at Aerojet Systems Div., Aerojet General Corp., presented an informative talk on the earth satellite program. *—Robert C. Gordon*



TUCSON — Scully-Jones representative Dale Price, right, spoke on "Down with Down Time and Up with Production," also demonstrating his company's new tapping head. Other note checker is Tucson Chairman Harry DeLong.
—J. W. Vincent

chapter news and views

Ladies Night Staged at Fels Planetarium

Philadelphia chapter brought back its annual ladies night after a two-year absence, with an unusual setting and speaker. After a buffet dinner in Franklin Hall of the Franklin Institute, some 120 members, wives and guests were treated to a talk by I. M. Levitt, director of Fels Planetarium, on "Satellites —American and Russian."

A demonstration of the Zeiss Multiple Striopicon, the instrument used to project the stars and planets on the ceiling of the planetarium, was the starting point for Dr. Levitt's talk. He then explained the how's and why's of sending earth satellites into orbit, and predicted that the first nation to send people into outer space would have the power to eliminate all future wars on this planet. *—John Chernokreluk*

LOS ANGELES—Ceramics used in aircraft and missile production was the subject of Speaker J. D. Welderlen (center), technical ceramics project leader of Gladding McBean Co., at Los Angeles' July meeting. Shown with him are Calvin Kindschi, program chairman (left), and Chairman Ben Hazewinkel.

Baltimore Sponsors Tape Control Workshop

"Tape Control for the Small Shop" will be the subject of a two-day workshop October 24 and 25, sponsored by the Baltimore chapter of ASTE. Directed toward the "forgotten man" in this field, the presentations of films, slides and lectures will show the smaller operator how he can employ the latest techniques used by larger plants in achieving automation.

To discourage the popular belief that tremendous investments are required to reap the benefits of this newest servant of the machine trade, the following firms are participating in the workshop: Bendix Aviation's Controls section; GE's Specialty Control division; Giddings & Lewis; Hillyer Corp.; Jones & Lamson; Kearney & Trecker; The Martin Co.; and the Warner & Swasey Research Co. Many of these firms will demonstrate with actual machinery.

The fee for the two days' sessions, including two luncheons, will be $10 for members and $15 for nonmembers. A banquet Friday night, October 24, will feature ASTE Vice President David Schrom as toastmaster, and an outstanding speaker on tape control. Cost of this banquet will be $5 for everyone.

Advance information about the workshop can be obtained by writing to: Edwin V. Kapp, Chairman, Public Relations Committee, 2523 Canterbury Rd., Baltimore 14, Md.

All-Summer Program Keeps Texans Enthusiastic

The North Texas chapter this year for the first time turned thumbs down on the customary three-month vacation from scheduled activities and held a full complement of technical meetings. The June plant tour through GE's Home Air Conditioning Division in Tyler, Texas, proved a smashing success, with excellent attendance. The July session on Chem-Milling presented by Turco Products Co. featured a demonstration, film and lecture. Scheduled for August was Ralph A. Fuhrer, chief manufacturing engineer at Convair's Fort Worth division, to speak on "The Tool Engineer's Approach to the B-58 Weapons System."

The chapter recommends the year-round programming to chapters that usually go out of business during the summer months, pointing out that, after a "dead" summer, it is difficult to re-create interest in chapter activities in the fall. Immoderate Texas temperatures proved no deterrent to interest or attendance. —*W.P. Engelfried*

SANTA MONICA BAY—Leading the way in establishing a chapter in this area are (from left) William Pike, membership chairman pro tem; J. J. Apalategui, secretary pro tem; Wayne Ewing, ASTE vice president; Joseph Koch, membership area captain; and Ralph Chrissie, vice chairman of the national membership committee. The first organizational meeting drew some 90 men who heard Mr. Ewing outline the Society's purpose and objectives. Plans were laid for a September chartering.

ROCKFORD—Eucational Chairman Earle Johnson poses with prize-winning students in the fixture design contest. Left of Mr. Johnson are Ralph Grienke, Jr., and John Nee, of Beloit, Wis.; to the right are Carl Jones, East Rockford; Jerry Bois, West Rockford; Larry Knauft, Freeport; and Richard Hackman, Belvidere.

—*Kenneth R. Bookland*

chapter activities

Baltimore	159	Philadelphia	158
Boston	161	Riverside	160
Evansville	160	Rockford	159
London—St. Thomas	158	San Gabriel	160
Los Angeles	158, 160	Santa Ana	158
Long Beach	160	Santa Clara	160
Northern Massachusetts	160	Santa Monica	159
North Texas	159	Tucson	158
Oregon State	161	Wentworth	161

chips and chatter

Santa Clara Valley

A plant tour of the Schick Products Co. was conducted by Mr. Schick at the July meeting. There was a special evening overtime shift to allow members the opportunity of seeing aluminum forging and allied equipment in operation. The tour covered aluminum forging operations on hydropress and mechanical press equipment, trimming and grinding, broaching and punching, and heat-treat operations.

At the June 17 dinner meeting held at Hawaiian Gardens, Roy J. Chandler specialist in value analysis and inventory control, Atomic Power Equipment Dept., General Electric Co., spoke on "Value Analysis, Its Philosophy and Key Techniques as Used in Producing and Procurement of Parts."

Riverside

A combined father and son night and technical meeting was held July 8 at Mile's Cafe, with 85 members and guests present.

The speaker was Everett J. Urbach, head of Presentation Section for Rockets, Aerojet General Corp., whose subject was "An Experiment in Space," a review of the United States earth satellite program.

Evansville

Members attending the June 9 meeting heard R. E. Cook, engineer for Indiana Bell Telephone Co. explain and demonstrate the many advantages of direct distance dialing, which will soon be in use in this area.

Long Beach

One-hundred-twenty members met at the Petroleum Club June 11 for their technical meeting and scholarship awards. Tom Vajda of Lockheed Aircraft Missile Div. spoke, after which the awards were presented.

Los Angeles

R. L. Johnson, assistant chief missiles engineer, Douglas Aircraft Co., spoke at the June meeting on the various types of missiles, such as air-to-air, surface-to-surface, along with the new Nike Hercules. Following his talk, a film was shown on the firing of the Thor and Nike missiles, with a question and answer period following.

San Gabriel

Eighty-seven members and guests enjoyed a color movie and talk on "Electrical Discharge Machining" by Tony Rotundo of Allied Pacific Mfg. Co., Los Angeles, at the June 5 meeting, held at Rainbow Angling Club. A movie on the 1957 Indianapolis races was also presented by Mobil Oil Corp.

Northern Massachusetts

The sixth annual outing for the benefit of the chapter ASTE scholarship fund was held June 28 at the Twisters Fun Club in New Salem. It was an all-day affair with 85 members and guests present. Guests were John Morosini, chairman of the Boston chapter, and representatives from area distributors and manufacturers. A varied sports program, an excellent dinner, and presentation of prizes capped a successful event, which added considerably to the scholarship fund.

Obituaries

Real Clavette, Montreal, manager of ABC Tool & Die Co.

Carl William Greunke, Toledo, assistant plant superintendent for Reichert Float and Mfg. Co.

Charles E. Johnson, Akron, tool salesman for Portage Machine Co.

John C. Maul, Mansfield, secretary and treasurer of Maul Mfg. Co., Inc.

William G. Meyer, Northern New Jersey, plant superintendent for Kidde Mfg. Co., Inc.

P. A. Patterson, formerly industrial relations chairman of Philadelphia, production engineer, United States Inspector Naval Materiel.

Carl E. Plummer, second vice chairman and formerly serving as treasurer, secretary and membership chairman of Tulsa chapter. Owner of Carl Plummer Mfg. Co.

SPECIAL EVENTS

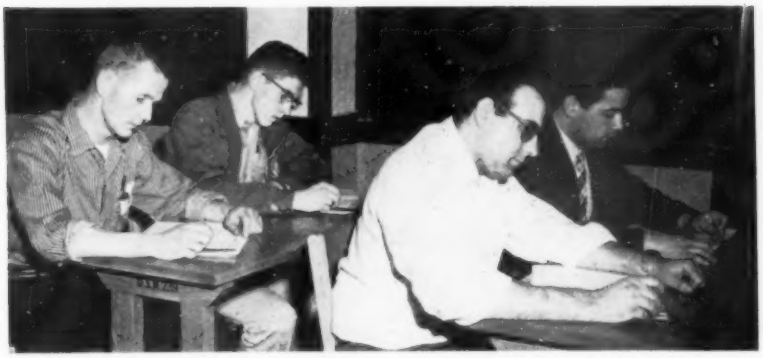
ASTE West Coast Tool Show.
Sept. 29-Oct. 3, Los Angeles Shrine Exposition Hall.

ASTE 27th Annual Meeting.
April 18-22, 1959, Schroeder Hotel, Milwaukee, Wis.

CHAPTER MEETINGS

PLACE	Sept.	SPEAKER	SUBJECT
Akron. Firestone Tire & Rubber Plant #1. 7 pm	16		Plant tour
Buffalo Niagara Frontier. Weimer's Grove, Lancaster, N. Y. 1:30 pm	6		Annual picnic (stag)
Des Moines. Des Moines Golf & Country Club.	10	**John L. Wright** Collins Radio Corp.	Temporary Tooling for Short-Run Applications
Elmira. Mark Twain Hotel. 7 pm	8	**Anthony A. Mauro.** Control Systems Co.	Tele Control
Indianapolis. Antlers Hotel.	4		"Pop Hiatt Night"
North Texas. D & L Ranch Grapevine. 7:30 pm	12		Social buffet barbecue and stag show.
Northern Massachusetts. New High School. All day	20		Talks on milling, broaching, sawing, etc.
San Fernando Valley. Hody's, North Hollywood. 8 pm	3	**Clifford Kennedy** General supervisor of tool design, North American Aviation.	Tooling for Rocket Engines
San Francisco. Officers Club. 6 pm	18	**R. E. Meyers** San Francisco Navy Yard	Tour of San Francisco Navy Yard —Invitation Capt. Floyd B. Schultz
Santa Ana. Palms Restaurant.	2		
Santa Clara Valley.	16	**Robert Hill** Maynard Co.	Methods Application in Jig and Fixture Design
Sydney. Institute of Builders Hall, Milson's Pt. 8 pm	10	**R. Hazelhurst** Sonnerdales Pty., Ltd.	Manufacture of Gears
Tulsa. Borden's Cafeteria.	9	**Alex Dreier**	Salute to ASTE and Tool Fair.

BOSTON—Two Boston area winners of the Society's international scholarships were guests at the Boston May meeting. Shown with the chapter's education chairman, Leonard Snow, are Paul Murphy (left) of Wentworth Institute, and Roland Mercier, student at Franklin Technical Institute.



WENTWORTH INSTITUTE—This enterprising student group hired an industrial psychologist to administer Kuder preference tests to the entire chapter to help members discover in what area of industrial vocations they would be best suited to work. The chapter showed a high degree of maturity for such a group.

OREGON STATE COLLEGE—Titanium and its industrial applications was the subject of one of Student Chapter 19's early technical sessions. Speaker was O. G. Paasche (left), professor of metallurgy at OSC, pictured with Portland Chairman William Simpson, and John McKay, chairman of the student group. The chapter was chartered in March.

Positions Wanted

PRODUCTION MANAGER — position desired by individual with 24 years' experience in steel fabrication. Twelve years managing shop that specialized in machine tool weldments. Previous experience in layout, flamecutting, setup, welding, etc. Could establish a new department or take over existing one. Write to: Box 126, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit, Mich.

MANUFACTURER'S AGENT—or state distributorship of machine tools, tools, or allied lines. Over 30 years' experience in machine tool line; wide acquaintance in New York and Pennsylvania. No objection to being on the road. Promise aggressive coverage. My headquarters is Buffalo. Write to: Box 125, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

TOOL ENGINEER—experienced in plant layout, design of test equipment, checking of tools, jigs and fixtures. Three and a half years' research engineering with large automotive manufacturer; location and installation of laboratory facilities, as well as design and installation of dynomometer test cells for farm pump equipment. Write to: Box 124, News Dept., The Tool Engineer, 10700 Puritan Ave., Detroit 38, Mich.

Position Available

MACHINE TOOL SALESMEN AND REPRESENTATIVES—Excellent opportunity to represent leading machinery firm in your area with full established line of NEW equipment (and/or used). Only apply if you have top sales record. Send all details first letter. Correspondence confidential. Write: L. D. Srybnik, S & S Machinery Co., 140 - 53rd St., Brooklyn 32, N. Y.

Youthful Kansan Ellis W. Akin Dies

Prominent member of ASTE's Kansas City chapter, and president of Ellis Akin Engineering Co., Ellis W. Akin died July 20 at the age of 36, after suffering a heart attack.

Mr. Akin was also president of "O" Staco Corp., a sales subsidiary. An Air Force veteran of World War II, he was active in Boy Scout work and in the Kansas City, Kan., Chamber of Commerce. He graduated from the Colorado School of Mines in 1949, and belonged to the American Society of Lubrication Engineers.

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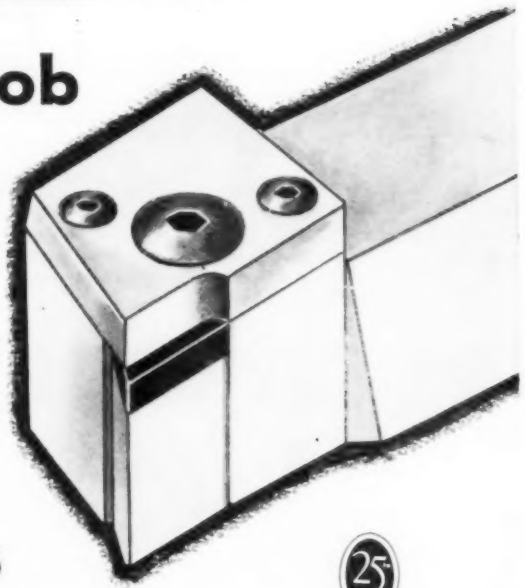

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Progress in Production

STUDY ELECTROCHEMICAL MACHINING METHOD

Forecast of tomorrow's method of machining tough heat-resistant metal alloys now being used in airplanes and missiles possibly is reflected by this feat, performed at General Electric Co.'s General Engineering Laboratory in Schenectady, N. Y. In this demonstration, the glass tube never touches the metal plate below it, yet the metal is being punctured.

This electrochemical machining technique involves use of chemicals and

electricity as a substitute for present conventional metallic cutting tools. There is no physical contact of the electrolytic cutting tool with the object being machined.

Studies currently are being carried on to find the most effective methods of applying the principle in actual practice. A. E. Howe, an engineer at the G.E. Laboratory, is shown with a test setup used in the work.

REPORT ON STEEL BAR IN MACHINING PROJECT

Test results from participation to date in Cone Automatic Machine Co.'s cooperative machining project "Comapro," are reported by Jones & Laughlin Steel Corp. which is supplying its Type A leaded steel bars for use in the initial test run of a spark plug shell, and other tests in the series. J & L's bar stock for the first project consists of $1^{3}\!/_{16}$-inch cold finished hexagons, 12 feet long. The project's purpose is to determine most efficient production procedures and materials to be used in production of machined parts by automatic screw machine.

Progress reports to date show that, with full utilization of the free-cutting capacity of this leaded steel and other factors, it is possible to increase productivity approximately 30 percent over previous machining output for this part. The test showed an index time per part of 4.41 seconds on a spark plug shell as compared to about 6.5 seconds under conventional shop practices. Parts produced also have fine finish, while tool life is extended and tool changes are minimized.

The report further indicates that machine shops making mass-produced metal items, where cost-per-part is an important factor, can reduce costs to a realistic minimum if they tool up properly for the work. For example, the use of preset, quick-change toolholders for the nine primary tools results in a saving of 37 minutes for each tool replacement cycle over conventional shop practices.

The project, of which J & L is a cosponsor, is under the direction of the Cone Automatic Machine Co., Inc., of Windsor, Vt. It will consist of a series of closely controlled test runs of various screw machine products, principally those made in large quantities. Cone is contributing a six-spindle Model TF bar Conomatic and the operating personnel for the tests, which are being conducted at the Cone plant in Windsor.

The ultimate goal of the cooperative

Operator loads a six-spindle bar Conomatic with J&L Type A $1^{3}\!/_{16}$-inch cold finished leaded steel hexagon bars from which spark plug shells are being machined.

machining project, is to develop better procedures for machining steel. It is expected to provide examples of minimum cost-per-part performance which will serve as educational material and as comparative guides for the metalworking industry. A number of machining innovations are being evaluated in the project. Sponsors other than J & L in the project are providing cutting oil, lubricants, cutting tools, quality control gages, toolholders, etc.

VALVES SPEED THROUGH AUTOMATIC EQUIPMENT

Continuous rolling of thin strip is possible by a high-speed cold reduction mill with individual 6-inch diameter x 8-inch face two-high mill stands mounted with their respective drives on one common base. Each set of rolls is driven by an adjustable speed motor through a combination gear reducer and

Photo courtesy Electric Boat Division of General Dynamics Corp

U.S.S. Skate, first production model atomic sub, carries a wealth of electric, hydraulic and mechanical equipment including numerous ANGLgear standardized 90° drives.

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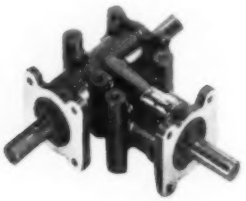
You can specify ANGLgear in 16 different stock models, ⅓ to 5 hp, with 1:1 or 2:1 gearing and 2 or 3-way shafting. See our literature in Sweet's Product Design File or contact our local distributor.



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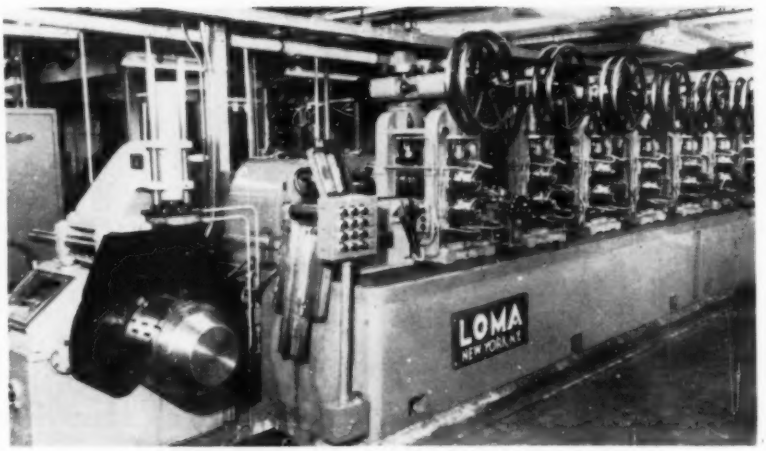


A manufacturer of venetian blinds and awnings uses this Loma mill to process low carbon steel and aluminum alloys to a finish gage of 0.006 inch, in widths from 2 to 6 inches. Design allows the mill to take total reductions of 95 percent while maintaining tolerances as close as 5 percent of thickness. One operator and a helper keep the machine producing.

pinion stand and a pair of universal joint spindles. Tungsten carbide sleeves are mounted on several of the rolls to obtain long operating life and high surface finish. Exact roll adjustment is facilitated by twin-hand wheel worm-drive screwdowns on each stand. For strip cooling purposes, the entire mill is flooded with soluble oil from a central circulating system. Several complete mill stands are furnished as spares for roll maintenance and are exchanged by overhead crane in a matter of 20 minutes.

The machine, developed by Loma Machine Mfg. Co., Inc., is normally fed with annealed re-roll stock ranging from 0.072 to 0.093-inch gage. At the entry side of the tandem mill, 16-inch ID x 40-inch OD, coils are paid off into No. 1 stand from a coil box equipped with a back-tension bridle. During its passage through the mill, the strip is positively guided so that the entire installation is self-threading. Vertical edge control stands are provided at four locations between horizontal stands.

Upon leaving the final mill stand, the strip is dried by a wiper bridle, is continuously measured by a "flying mike" and is coiled by the winding reel. The reel is equipped with a 16-inch-diameter collapsible drum, a belt wrapper mounted in a pit, a coil stripper and a hold-down device. All these auxiliaries are hydraulically actuated and are electronically controlled to obtain automatic cycling. A magnetic amplifier control on the motor that drives the reel facilitates constant tension winding. The entire mill electrical drive operates on the adjustable voltage system with controlled acceleration and deceleration and has special provision to maintain constant strip tension between stands.

The mill illustrated, installed by a manufacturer of venetian blinds and awnings, is used to process low carbon steel and aluminum alloys to a finishing gage of 0.006 inch, in widths from 2 to 6 inches and at output speeds up to 1000 fpm. Its design allows the mill to take total reductions of 95 percent while maintaining tolerances as close as 5 percent of thickness. It requires one operator and a helper.

TITANIUM ALLOYS OFFER BONUS QUALITIES

Three new heat-treatable titanium alloys can be readily formed in the solution treated or "soft" condition and then strengthened by simple thermal aging treatments. Strengths obtainable with these alloys, developed by Crucible Steel Co. of America, are higher than previously considered possible in titanium sheet materials.

Prime among the new group is an all-Beta titanium alloy designated B 120 VCA. Its status in the titanium industry is considered comparable to the development of austenitic stainless in the stainless steel field. The other two alloys are identified as C 105 VA and C 115 AMoV. The former is an Alpha-Beta type titanium base alloy containing 16 percent vanadium and 2.5 percent aluminum. The latter titanium-base alloy contains 4 percent aluminum, 3 percent molybdenum and 1 percent vanadium. It has an elevated temperature stability to at least 800 F.

They're now available from stock in new standard 18" lengths!

ACE

LONGBOY DRILLS

Been buying costly "specials" for deep hole drilling operations? Then you'll be glad to know that Ace Longboy Drills are now available from stock in a wide range of standard sizes and in both 12" and 18" lengths! What's more, their polished flutes are precision ground in top quality pre-hardened high speed steel to provide a finer finish, keener cutting edges, and longer drill life.

Call your local Ace Drill Distributor today!

NEW CATALOG covers the entire line of Ace "Ground-from-the-Solid" High Speed Steel and Carbide Drills, Reamers, Drill Blanks and Special Drills. Send for it today!

ACE DRILL
ADRIAN, MICHIGAN

ORIGINATORS OF "GROUND-FROM-THE-SOLID" DRILLS
INDICATE A-9-165-1

CHEMICAL MILLING ADVANCES MAGNESIUM USES

Developments in chemical milling for the Mag-Thorium family of magnesium in sheet, extruded and cast forms have simplified machining processes in fabrication of aircraft and missile components from these middle range, high-temperature resistant and mildly radioactive metals. As bonus features, the advances have reduced tool costs while eliminating health hazards.

The Mag-Thorium metals have become important because they span the gap in strength-temperature range between conventional aluminum and magnesium alloys and heavier steel and titanium alloys. Critical strength temperatures for conventional aluminum and magnesium alloys range from 300 to 350 F; those of Mag-Thorium alloys range from 350 to 500 F.

Health hazards of low radioactive rates of thorium elements in Mag-Thorium are mainly limited to internal radiation from inhaled dusts. As United States Chemical Milling Corp. points out, in chemical milling no dusts are produced and fuming is negligible.

Simple or integrally reinforced skins and structural members, either straight or tapered, can be handled by chemical milling even in large sizes and numbers without essentially increasing complexity of basic tooling.

Semiautomatic handling of door hinge reinforcement members during forming operations at the Ford Stamping Plant in Chicago, demonstrates application of electric motion control to manufacturing operations. The simple installation permits fast and accurate positioning of work under the forming die.

Door hinge reinforcement member blanks for Mercury passenger cars can be moved in and out of the forming operation by a single operator. Incoming blanks are dropped down an inclined chute under rubber rollers to the die area. When the operator pushes the start button for the press cycle, a series of fingers catches the part from the rear and pushes it under the die against a stop on the far side.

Drive for the automatic loader that includes the parts-holding fingers is actuated by a clutch-brake made by Warner Electric Brake & Clutch Co. If the parts-handling fingers exert too much force, the blank can be bounced off the stop and end up slightly off center. Tuning down the torque by dialing the rheostat knob on the clutch-brake control permits precise torque control, insuring accurate work stopping.

Removal of the formed part from the

New TUMBLE JIG

Available in 47 sizes

Patent Applied For

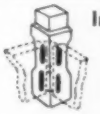
Offers Many Big Advantages

- ONE-HALF THE WEIGHT
- TRI-METAL CONSTRUCTION — Aluminum — Cast Iron — Steel
- 6-SIDE UTILITY — Can Use Head-Type Bushings, on Sides, Top, Bottom
- 5 HANDLE LOCATIONS — Handle can be attached to Any Side or Bottom
- ONE HAND OPERATION — Thumb screw releases Lid Instantly
- LEAF "POP-UP" — Automatic Action Spring Plunger Snaps Lid Open
- STABLE — Rugged Construction

Standard Parts is First with Exclusive New "TUMBLE" Box Jig

New design features, new engineering concepts, new construction techniques . . . are incorporated in this outstanding line of "Tumble Box Jigs. By combining 3 metals — aluminum, cast iron, steel — half the weight has been eliminated. This increases efficiency and production. The sturdy handle (can be located on any side) makes tumbling fast, easy and safe.

Bushings can be used on all 6 sides. A unique interlocking feature is the aluminum through the cast iron legs, which assures strength and stability. Walls can easily be machined without distorting the Jig. 47 Sizes available 1" x 1" x 1" to 4" x 8" x 4". *Full size Tracing Templates are available for all 47 sizes.*



Interlocking Leg Joint

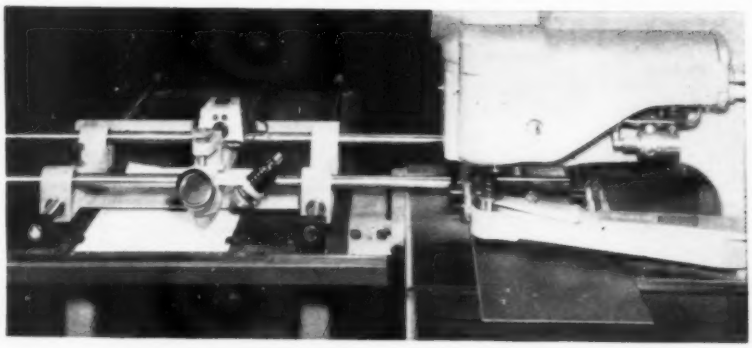
Aluminum goes all the way through the cored slots in the cast iron legs — forms a unified, interlocking joint — assuring light weight, but rugged strength.

HANDLE may easily be attached on any side or bottom of the jig as needed.

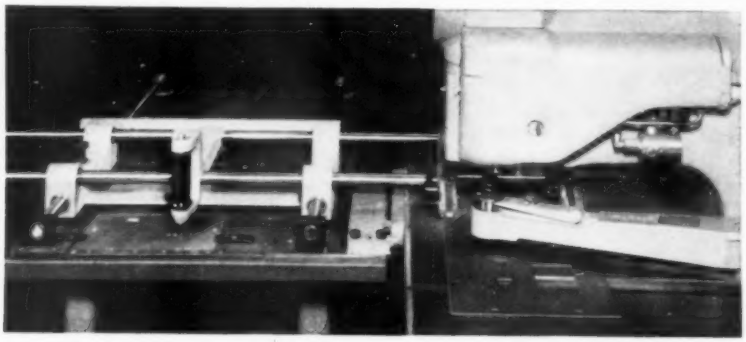
TUMBLE — Universal tumble direction is advantage of this light-weight jig — where handle can be located where desired.

Ask for TUMBLE JIG BULLETIN

STANDARD PARTS CO.
1012 BROADWAY • BEDFORD, OHIO
INDICATE A-9-165-2



shortest distance
between blueprint and product



The DUPL-O-SCOPE

Firms punching or notching sheets up to ¼" mild steel in medium runs know how profitable it is with a Strippit Fabricator-Duplicator. Now, it's even faster with the new Dupl-O-Scope, which eliminates the template drilling and layout step!

Readily mounted in the Duplicator stylus bracket, this precision optical pickup device quickly translates a drawing, layout or printed circuit sample into a punched metal template — ready for rapid-fire punching and notching on the Fabricator-Duplicator using standard interchangeable tools or "specials" made up to your requirements.

Write today for catalog and an actual demonstration on *your* work at *your* plant by a Strippit Mobile Unit. Warehouse stocks at Chicago and Los Angeles.

The versatile Strippit Fabricator, one-machine shop for quick-change punching, notching and nibbling — available with positive Duplicator for high-speed production punching and notching in complex patterns including printed circuit boards.

WALES

STRIPPIT

Company

211 Buell Road, Akron, New York

In Canada: Strippit Tool & Machine Limited, Brampton, Ontario

HOUDAILLE INDUSTRIES INC.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-166

Operator slides a blank for door hinge reinforcement member down a ramp. A series of fingers will pick up the blank and position it under the die.

press also uses Warner electric brake and clutch control for the sidearm extractor. This component, designed by Ford and built to the company's specifications, is actuated from limit switches mounted on the press ram.

Because its actuation is electrically controlled, it is possible to tie the operation of the extractor to the press movement in a simple installation free of weak links. The electric clutches and brakes require 30 watts of d-c to energize their magnets; instant energizing permits rapid switching from brake to clutch or vice versa.

METHODS CHANGE NETS NEW ECONOMY

By conversion from machined sprockets to die stamped sprockets, under Dayton Rogers Mfg. Co.'s short-run stamping process, two stampings have been satisfactorily introduced at a considerable saving: one with 8 tooth and one with 16-tooth for No. 1 ladder chain.

Only one side of the stamped sprocket blank had to be chamfered to receive the ladder chain properly. The other side of the sprocket, or die side of the stamping, had enough pullover or chamfer to make a desirable working part. Sprocket blanks were silver soldered or brazed to the shouldered, drilled and tapped sprocket bushing.

The stamped sprocket with screw-machined hub inserted permitted an over-all cost of the unit of 75c which amounted to a reduction in cost to the customer of 60 percent.

On a later design the shouldered bushing was straddle milled with two

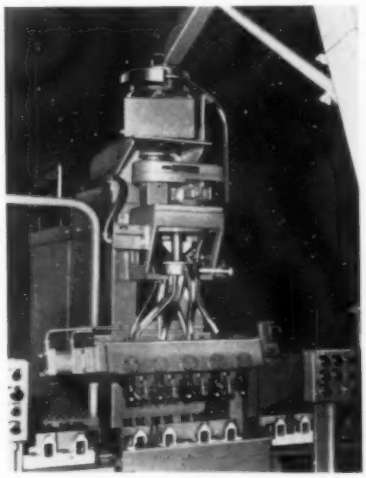
flaps. The pierced hole in the two sprocket blanks was of a size and shape to receive the shouldered and milled bushing, and then the shouldered bushing was staked in the required blanked and chamfered sprocket. This latter gave a more desirable job in event that either one of the completed sprocket assemblies had to be a driver.

PRECISE PARTS LOCATION BY ELECTRIC MOTION CONTROL

Unusual transfer mechanism of a machine, which assembles V-8 cylinder heads at a rated capacity of 310 an hour, lifts and carries parts between the stations without pallet fixtures.

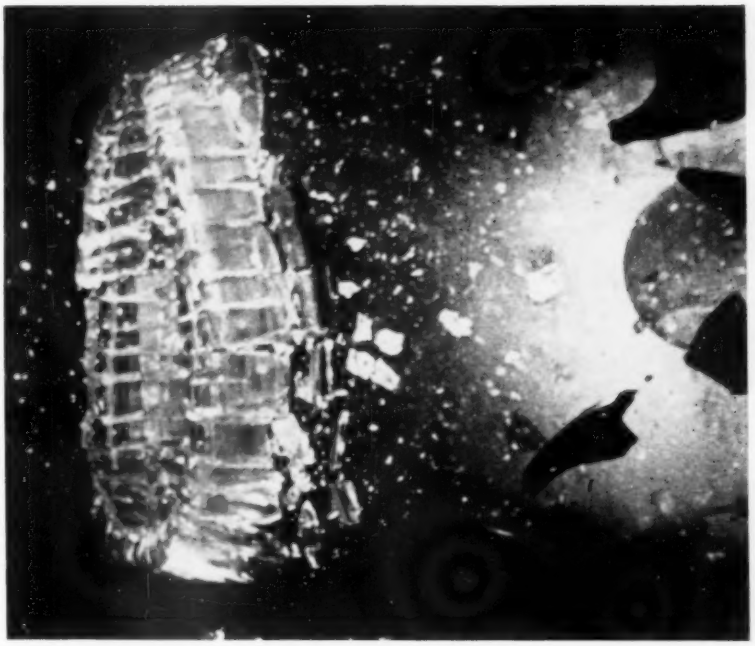
Cylinder head castings with intake and exhaust valves in place are loaded automatically at Station 1 of the machine, while at Stations 3, 4 and 5 rubber grommets are placed over the valve stems. An inspection is made for faulty valves and grommet positioning at Station 7; if necessary, heads are removed, repaired and returned to Stations 8, 9 and 10.

Valve springs, spring retainers and spring retainer sleeves are automatically assembled at Stations 11, 13 and 15, respectively. Valve locks are automatically assembled at Stations 17 through 23 with standby units for manual assembly at Stations 19 and 23. All valves are "popped" at Station 25 before the finished assemblies are unloaded at Stations 27, 28 and 29.



One of the automatic valve lock assembling stations on the 29-station machine built by The Cross Co. to assemble V-8 cylinder heads.

Building block construction provides flexibility for engine design changes and for additional automatic assembly devices in the future. All parts, including tooling details, are made to interchangeable tolerances.



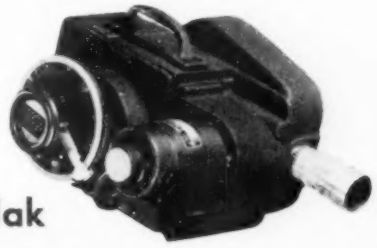
Single frame from a high speed movie of an imploding television picture tube—a critical instant seen in relation to what preceded and followed during a spread-out fraction of a second.

Ever see a really high speed movie?

It's something to see—a one-second swipe of a cutting tool spread out to three minutes on the screen! Seeing a cam that is really turning at 500 RPM (and behaving that way) as though it were turning at 3 RPM! Studying the action of explosions, welding bead deposition, forging . . . all slowed as much as 200 times from normal.

We've put together a movie on the Kodak High Speed Camera that will show you what high speed movies can do. It will also give you some ideas on how you might put high speed movies to work solving your own design, production, and performance problems that involve high speed mechanical action or fluid flow. To arrange for a showing to company groups of the 16mm sound movie, "Magnifying Time," write:

EASTMAN KODAK COMPANY, Rochester 4, N.Y.



the Kodak HIGH SPEED Camera

Kodak TRADEMARK

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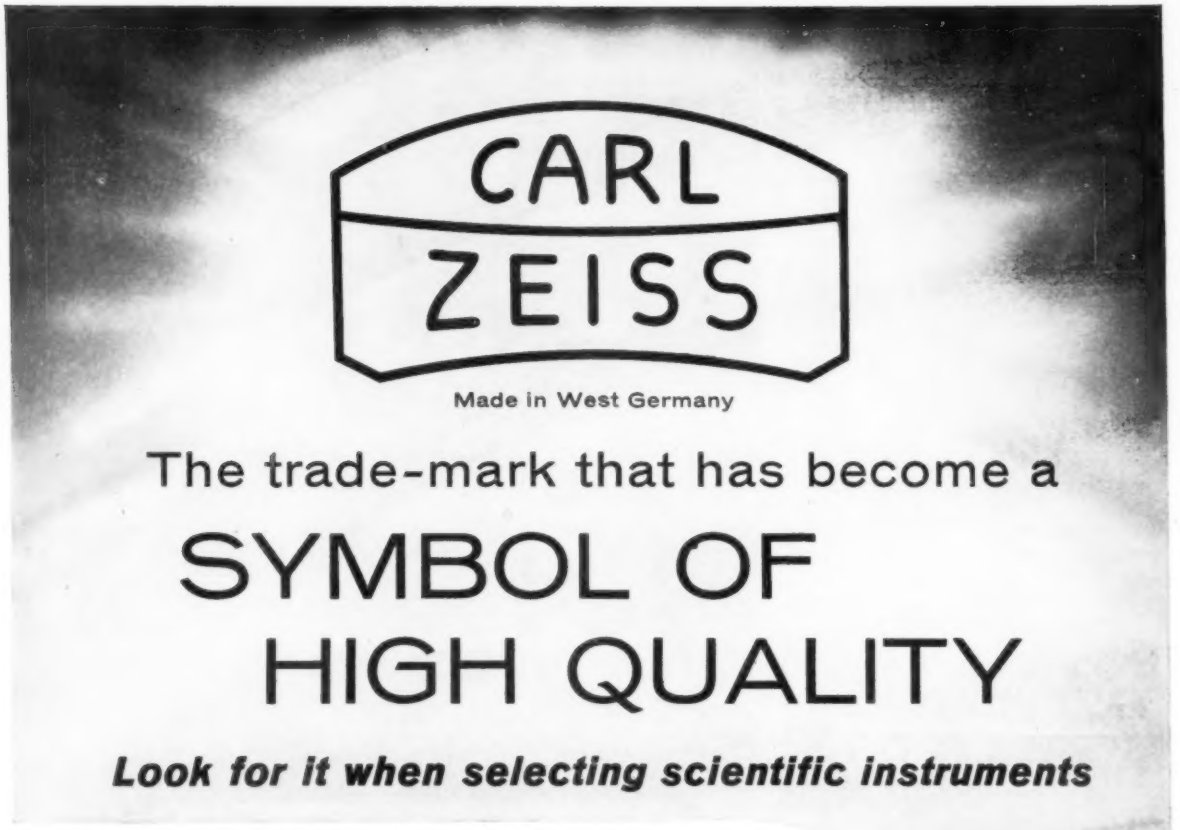

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TOOLS of today

Friction Saw

Designed as one-piece construction, this friction saw incorporates an electronic feed, and a special coolant system that assures cool-edge, dry-blade cutting. The saw which can be used as a semiportable tool has been produced in 40, 75 and 150 hp sizes.

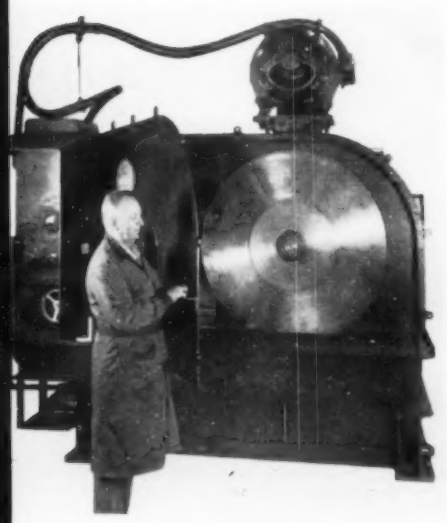
The saw's electronic, adjustable torque feed is a self-contained unit with a built-in cooling system. The reservoir is built into the base and is readily accessible for cleaning through steel grating covers. Installation of the saw requires four foundation bolts, electrical current supply and periodic access to water; no pits, bases or drains are necessary.

High blade edge speeds attained by this saw generate an air-flow barrier that partially repels sprays. A 15-hp pump propels a high-speed water stream with a 140 psi force that penetrates the surrounding air barrier as the blade leaves the cut.

A curtain of steel encloses the blade except for the material opening. The operator's station is shielded on three sides by steel plate and has an unbreakable observation window, which affords close-up vision of the work. Controls are contained on a pushbutton panel. An adjustable pickup bar, operated by a handwheel at the operator's station, prevents binding of the circular saw blade by warped or bowed structurals falling against it after being cut.

Blade travel into the material is power-screw driven by means of a variable speed motor and a device that automatically adjusts the pressure as the blade passes through different thicknesses of structural shapes.

Ty-Sa-Man Machine Co., 1105 White Ave., Knoxville, Tenn. **T-9-1**



Paste Lapping Compound

Plastic molds can be polished and dies and blanks lapped successfully with the use of Tetrabor paste which has over 80 percent of diamond hardness and which provides unusually high pressure resistance.

The paste also is useful for polishing die casting dies, lapping of gages and holes in die work, and die faces and the lapping of cutting edges of various types of cutting tools, and for lapping valves and other moving parts to reduce friction.

The paste can be loaded easily on all cast iron or brass lapping wheels, as well as wooden dowel pins for the lapping of holes. It can also be used with felt bobs or mounted brushes for mold polishing. If necessary, the paste can be thinnned down with a light oil.

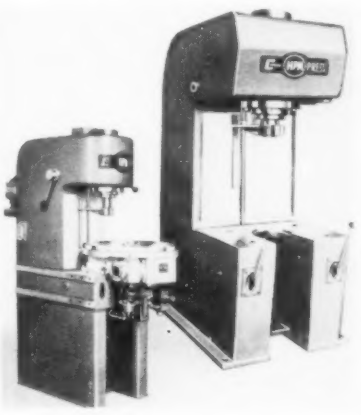
Tetrabor paste is supplied in 100, 120, 150, 180, 220, 250, 280, 320, 400, 600, 800 and 1000 grits. A kit containing one 5 gr tube of each grit also is available.

Titan Tool Supply Co., Inc., 1419 Hertel Ave., Buffalo 16, N. Y. **T-9-2**

Hydraulic Presses

Two manual and two automatic small, fast-acting hydraulic C-frame presses are built in 5, 10 and 15-ton capacities.

Manual C-presses are offered for dual lever safety control operation, and also with servocontrolled action, which permits the operator to apply ram force upon the work at speeds and pressures directly proportionate to the movement



of the hand lever. The basic automatic model provides controls for either single or automatic cycle, and ram reversal to either distance or pressure settings. A positive ram guide assures accurate positioning of the ram so that alignment of tooling is held to close tolerances.

The second automatic model possesses the basic automatic press features plus control elements for the hydraulic interlock of a hydraulic index table. The C-press index table is designed with a work circle of 16 in. with either 6, 8 or 12 stops for mounting of tooling, and is capable of carrying a full work load of 100 lb at speeds to 80 indexes per minute. A smooth acceleration and deceleration barrel cam principle for indexing the table, positions work carriers

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INDICATE A-9-170

beneath the ram within 0.002 in. Speed is valve controlled. The table may also be manually indexed while tooling or fixtures are being set up. Design of the table is such that ejection cylinders or other tooling elements may be directly mounted to the housing beneath the table dial. Table construction permits air, electric or cutting oil lines to be brought through a hollow spindle in the center of the table when any of these services are required on the dial surface. The dial is sealed from the indexing mechanism to permit use of cutting oils or coolants at the work stations.

The Hydraulic Press Mfg. Co., Div. of Koehring Co., Mount Gilead, Ohio. **T-9-3**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

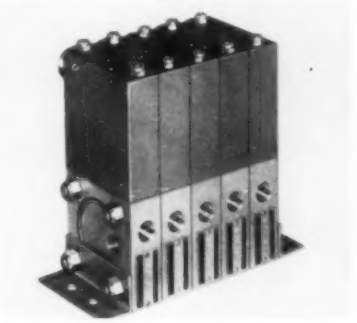
Punching Device

Sequential punching of metallic and other materials on a low cost, automatic basis is now possible with this punching device. The sequential punch, which is engineered for the small shop with restricted space, employs small, hydraulic pumping and valving units to attain required operating pressure and control. The device is capable of high-production speeds with only limited reactive forces imposed on the machine's framework. This permits relatively lightweight construction and compact design.

The Commonwealth Engineering Co. of Ohio, Dayton, Ohio. **T-9-4**

Solenoid Control Valve

Measuring 1 in. thick, 3 in. wide and $6\frac{1}{16}$ in. high, Quick-As-Wink solenoid operated S-3C-S valves can be mounted easily when space is extremely limited. They can be used with air or oil at pressures to 125 psi and temperatures to 150 F. The S-3C-S valves are furnished tapped for either $\frac{1}{8}$ or $\frac{1}{4}$-in. pipe connection, and are rated at 300



cpm for continuous operation, and up to 700 cpm for intermittent service on air at 120 psi.

The valves are available in normally closed or normally open 3-way or 4-way action. They can be manifolded together without any special parts.

The solenoid is fully enclosed in a brass housing; and positioned on two resilient O-rings with a spring to minimize shock and vibration.

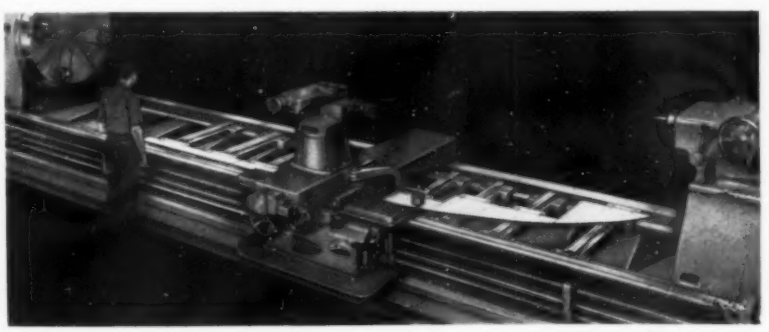
C. B. Hunt & Son, Inc., Salem, Ohio. **T-9-5**

Contouring Lathe

Designed for precision contour turning, boring and facing large thin-walled and fabricated parts, the Missile Master lathe provides large swing capacity, ultraclose machining tolerances and critical surface finishes. Clearance diameter of the machine is 85 in., with a 67-in. cross slide swing. Bed lengths are available up to 300 in. between centers, in increments of 48 in. The lathe, which is equipped with a swiveling air-gage tracer contouring system, has a 25-hp drive motor which is more than adequate for all recommended work.

Low spindle speeds are achieved through use of a face plate drive headstock design.

The speed range through face plate drive covers eight speeds from $1\frac{1}{4}$ to 30 rpm. Driving power for the 16 speeds in the high speed range, $1\frac{1}{4}$ to 250 rpm, is applied directly through the spindle. The Missile Master's main



drive motor is a 4:1 adjustable speed d-c type; each of the lathe's 24 speed settings also is infinitely adjustable 4:1. Successive ranges have considerable overlap. The standard face plate is 50 in. in diameter. An 80-in. diameter face plate is available on special order. A range of eight extra low spindle speeds, ranging from $\frac{1}{32}$ to $\frac{3}{4}$ rpm, also is available, as an option, for use in thread milling. Employing 6 in. circular feed in inches per minute, the Missile Master is capable of milling threads on any missile component between $2\frac{1}{2}$ in. and 67 in. in diameter.

The Monarch Machine Tool Co., Sidney, Ohio. **T-9-6**

Dial Snap Gage

Reed linkage transfer is employed by this line of lightweight gages. Five models cover the range from 0 to 8 in.

The gages have carbide faced anvils, adjustable backstop, stainless steel bushing in lower anvil. Boice "Staba-

lock" parallel locking mechanism and gearless indicator graduated in 0.0001 in.

They are available in two series: flat and parallel anvil type, and a spherical upper anvil type.

Boice Gages, Inc., Hyde Park, N. Y. **T-9-7**

Boring Head

An offset in the A-1 miniature Deka-Bore boring head compensates for tool grinds. The head is the smallest ever made for precision boring machines, measuring only $2\frac{1}{4}$ in. diam. and $1\frac{15}{16}$ in. long, and weighs 22 oz.

It will hold quills up to $\frac{1}{2}$ in. diam. It incorporates Deka-Dial, which permits positive 0.0001 in. adjustments without backlash. These adjustments can be made with any conventional boring tool without loss of performance. It also has a calibrated micrometer screw that can offset the tool slide to compensate for tool grinds. Adjust-

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TE-023

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ments of up to $\frac{1}{8}$ in. can be made on the diameter.

The head can be adapted to fit any standard machine, and will work vertically or horizontally. A model without the offset feature is shorter and lighter, and can accommodate $\frac{1}{2}$-in. bars.

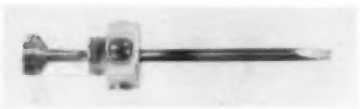
Precision Tool Mfg. Co. of Illinois, 1305 S. Laramie Ave., Cicero 50, Ill. **T-9-8**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Torque Screwdriver

This Model J Midget torque screwdriver has an adjustment range from 0 in-oz to 5 in-lb, and maintains its torque setting within 5 percent. A patented spring-loaded ball and detent principle prevents any wear on the torque control components.

The tool is factory preset to specific torque requirement. Torque adjustment



screws permit adjustment to the exact required torque within a given range.

The lightweight Model J has $\frac{3}{4}$-in. max diam.

Overload Control Co., 200-11 Langston Ave., Glen Oaks, Floral Park, N. Y. **T-9-9**

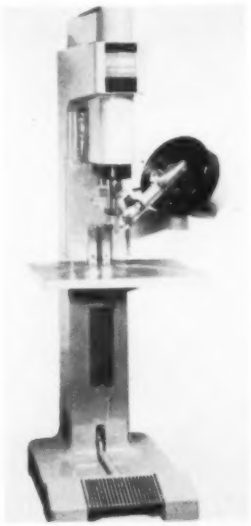
Power Screwdriver

Model U magazine-fed power screwdriver incorporates a positive control clutch, a hopper driving mechanism, new feed track and a solenoid operated escapement mechanism. It is available as a floor type machine or without the floor pedestal as a self-contained driving head for use in automatic assembly machines incorporating straight-line transfers, etc.

Driving range of the Model U is from No. 6 x $\frac{3}{16}$-in. long to No. $\frac{1}{4}$ x $1\frac{1}{2}$ in. long screws. There are no exposed moving parts; drive motor and belt, pulleys, upper spindle and clutch assembly are enclosed in a single column with all parts accessible for servicing.

Absence of friction devices in the machine permits the screwdriver to hold a constant torque. Unaffected by temperature changes or excessive oil or grease, the clutch is adjustable from a minimum of 15 in-lb to a maximum of 120 in-lb, holding a tolerance of ± 2 in-lb at the lower range to a ± 6 in-lb at the higher range under all normal driving conditions, using any standard screw.

The screw feeder tracks are adjustable for the complete range of the machine and the solenoid-operated



escapement is designed so that screws can be released by cutting off either on the body of the screw or on the head.

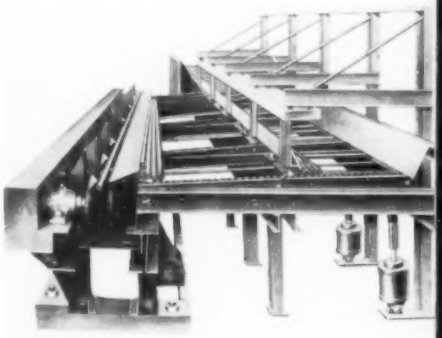
Spindle stroke is actuated by an air cylinder and pressure regulating valve which permits complete control of the spindle when the workpiece must be located by sight. The spindle may be stopped at any point and the up or down speed adjusted as required. Machine operation can easily be changed from automatic to manual in the event of air pressure failure. The hopper, track escapement and finger mechanism can be assembled on either side of the central column without special parts.

Detroit Power Screwdriver Co., 2801 W. Fort St., Detroit, Mich. **T-9-10**

Bar Feeding System

The Big Four automatic bar (or tube) feeding system serves four function: At the loading end, it receives bundles of either bar or tube stock; transfers these bundles any required distance to a bundle unscrambler; sorts the bundles and transfers the bars, preparatory to feeding; and, at the opposite end of the machine, feeds the bars (or tubes) singly as needed. Fully automatic, it provides a continuous operation from the bundle storage area to the final feeding.

The system has been designed so that it can be synchronized with any auto-



matic take-away system. It also is adaptable to electronic control. The entire operation can be controlled by means of tapes, cards or other programming devices, thereby making it possible for one operator to handle more than one line of shears or cutoffs.

Spurgeon Co., 23501 Hoover Rd., Warren, Mich. **T-9-111**

Expanding Collet

An expanding member incorporated in this collet locates and holds work from the inside, using existing 5C, 4C and 3C equipment (lathes, milling ma-

chines, grinders, fixtures, etc.) No extra attachments are required. Accuracy within 0.0005 in. is possible on concentricity, and the expanding collet holds close shoulder tolerances.

The soft mandrel may be machined to fit any ID within the $\frac{3}{8}$ to $1\frac{5}{8}$-in. range of the collet. Larger and smaller sizes also are available. Standard length is 1 in. The solid taper on the collet,

once seated, will not draw back into spindle; thus, a machined shoulder will hold the width dimension within 0.001 in. The collet may be removed and replaced in the machine without affecting its accuracy as in any standard collet. For an accuracy within 0.0005 in., a slight truing cut will suffice.

The collet, which operates with the spindle moving, may be transferred to any machine using standard 5C collets.

Dunham Tool Co., Inc., Danbury, Conn. **T-9-112**

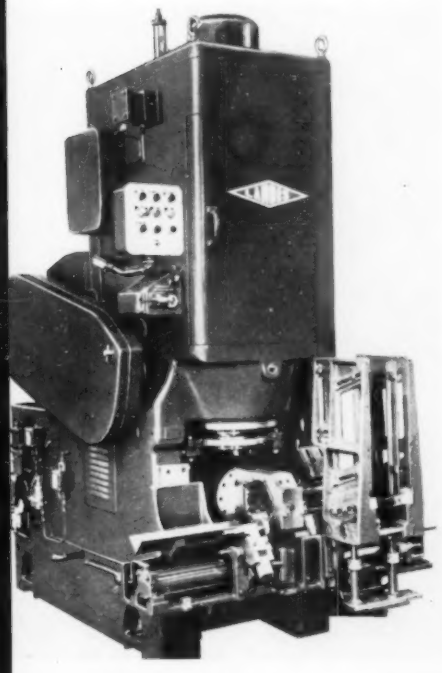
USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Coupling Tapping Machine

Model 77TA automatic coupling tapping machine is designed for internal threading of oil tubular and commercial couplings ranging from 2⅞-in. drill pipe external upset to 9⅝ in., long thread, casing couplings. The equipment is pneumatically operated and electrically controlled; the operator loads the magazine and supplies visual inspection.

Production rates range from 56 3½ in. line pipe couplings tapped at 37 fpm, to 11 9⅝ in., long thread, casing couplings threaded at 27 fpm.

Change of the vee belt drive pulleys when using an a-c constant speed motor afford 10 spindle speeds, ranging from 7 to 56.8 rpm. Either an a-c mechanical variable drive or a d-c variable speed motor allowing adjustable spindle speeds ranging from 4.5 to 54 and 6.5 to 53.5 rpm respectively, can be supplied.

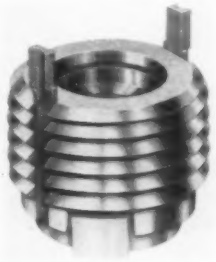


A receding chaser tap mechanism assures threads of positive and precision taper with infinite settings from ¾ in. to 0 taper per foot. Detachable tap heads allows wide range coverage with minimum tooling cost.

Landis Machine Co., Church and Fifth Sts., Waynesboro, Pa. **T-9-113**

Threaded Insert

Self-aligning internally threaded insert, called KeeNserts, are designed to compensate for misalignment of bolt holes in mating parts. Supplied as one-piece units, they may be screwed by hand into tapped holes prepared with standard drills and taps. They are



available with an internal thread lock. Prevailing torque is consistent after repeated installations and removals of the bolt.

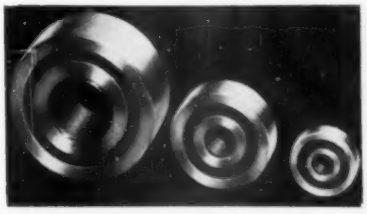
The KeeNserts are externally threaded to provide maximum resistance against pull out. Positive mechanical resistance to rotation is provided by KeeNsert Kees, which are tightly fastened in the inserts and are pressed into the base material with a small punch and hammer or installation tool.

Newton Insert Co., 6500 Avalon Blvd., Los Angeles 3, Calif. **T-9-114**

Diamond Dressers for Honing Stones

Tru-Hone diamond dressers provide fast truing for honing stones and also act as a guide in establishing the size setting.

These dressers contain small diamonds, metal-bonded into a ring or bushing, the inside diameter of which is made to the same size as the inside diameter of the part to be honed. This ring is assembled into a manual type holder or into a holder located in a honing fixture.

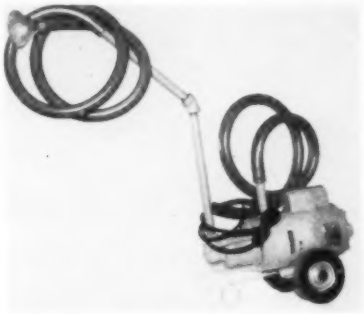


In use, the honing stones are adjusted approximately 0.001 in. oversize; the dresser is stroked over the stones while the machine spindle is rotating. Usually one or two strokes will produce true stones.

Staple Engineering Co., 1315 S. Woodward Ave., Birmingham, Mich. **T-9-115**

Coolant Pumps

A coolant service pump simplifies emptying of coolant tanks, transferring clean coolant to reservoirs, flushing under pressure machine coolant tanks and



lines. It also serves as a satisfactory standby pumping unit.

This pump delivers 1 gal of coolant every 4.7 sec with 25 ft suction lift. It operates on 110 v, utilizing ⅓-hp electric motor, using the Moyno positive pressure pumping principle.

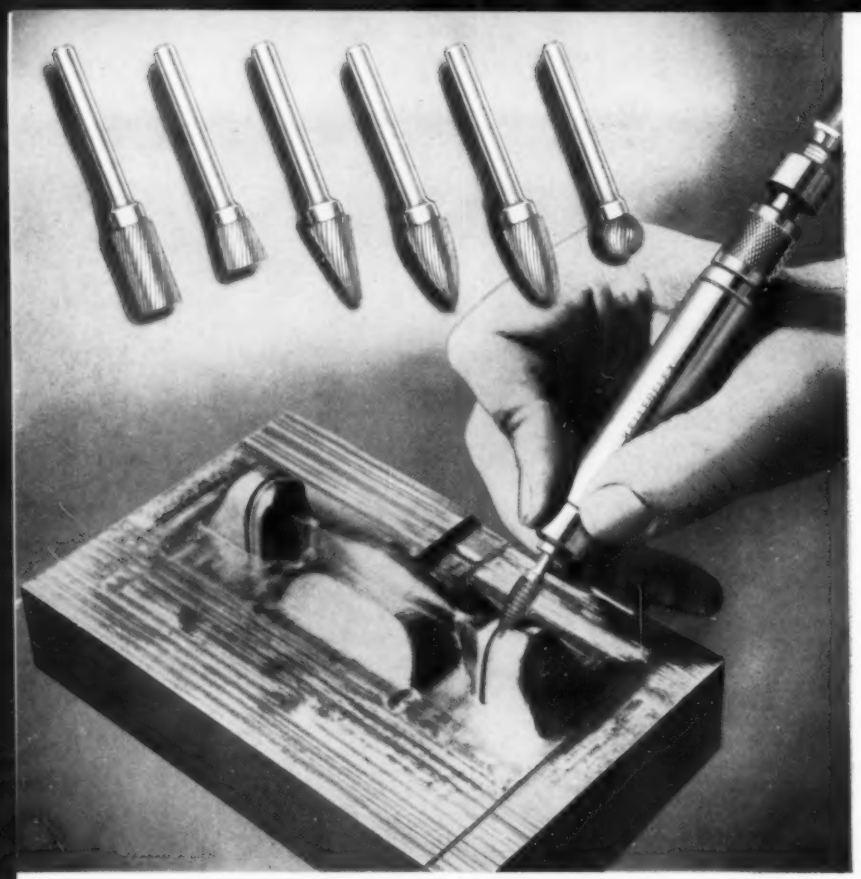
Associated Engineers, Inc., Springfield, Mass. **T-9-116**

Hydraulic Cylinders

A variety of standard rod ends and head ends permits a line of hydraulic cylinders to be specially assembled to suit specific needs. Five rod ends and 2 different head ends are offered for any type of cylinder.

Double-acting and single-acting cylinders are available for both general and special-purpose applications. Single-acting cylinders are offered in either the piston or displacement style; double-acting units are available in piston style only. Working pressures range from 1250 to 3000 psi with intermittent working pressures up to 4000 psi tolerated in some of the double-acting cylinders.

Working stroke ranges from 6$^{9}/_{16}$-in. min for general-purpose double-acting



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cylinder, to a 22-in. max for the special-purpose unit. Effective push areas range from 1.76 to 50.26 sq in., while pull areas from 1.32 to 21.21 may be selected. Bore diameters ranging from 1½ to 6 in. can be matched with rod ends from ¾ to 4½-in. diameter.

Pinhole sizes are large enough for bushings and can be made to fit special applications. Cylinder ports accept NPTF fittings. They can be either forged or street ells, and can be straight thread or crushed seal type. Clevis and foot type mountings are standard types available.

Special-purpose double-acting hydraulic cylinders are fitted with double section piston rods which permit oil passage to both ends of a double-acting cylinder but do not require hose connections to the cylinder barrel.

Wooster Div., Borg-Warner Corp., Wooster, Ohio. **T-9-117**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Electronic Micrometer

With this digital read-out automatic electronic micrometer, standard reference measuring pressures can be set to 1.5, 5, 10 or 20 grams; with a special

tip, lower measuring pressure is possible.

The instrument can check fragile or compressible materials, conducting or nonconducting, as well as metallic or hard parts. The unit can be operated from either a lever or foot switch.

J. W. Dice Co., Englewood, N. J. **T-9-118**

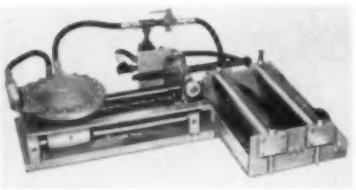
Air Feed

This mobile type air feed for feeding coiled materials to punch presses is designed for easy mounting directly to a bracket on the side of the press. Only other tie-in necessary with the press is

the mounting of a valve in such a manner that it is actuated by some moving part of the ram or die.

The Ses-Matic air feeds are available in three models to accommodate stock widths from 1 to 6, 12, 18, 24 or 30 in. and stock thickness up to 0.090 in. Maximum stroke length of the air feeds are adjustable from 1 to 6, 12, 18, 24, 30 or 36 in. Special models for stock up to 60 in. wide are also available.

Built-in speed control valves permit independent adjustment of the speed of



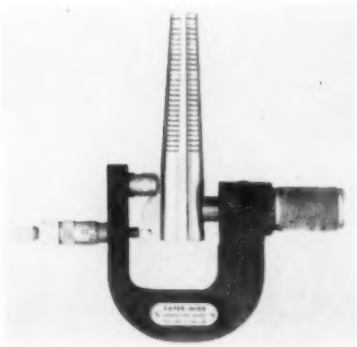
both the forward and return stroke of the feed. Increased area in the diaphragm gripper assembly provides increased clamping pressure on the stock being fed. An enlarged hydrocheck assembly provides improved cushioning effect of feed stroke. A reservoir automatically fills the hydrocheck when required.

Special Engineering Service, Inc., 8161 Livernois Ave., Detroit 4, Mich. **T-9-119**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Micrometer

This internal taper micrometer is designed on the same principle as the manufacturer's external taper micrometer to measure tapered holes. The micrometer utilizes application of a 1-in. sine bar to determine accurate measurement to ±0.0002 in.

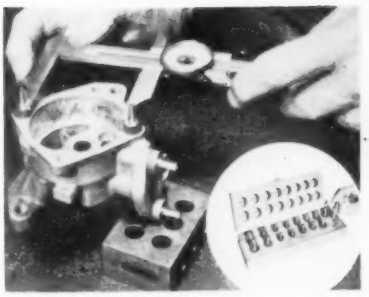


Taper Micrometer Corp., 100 Grove St., Worcester, Mass. **T-9-120**

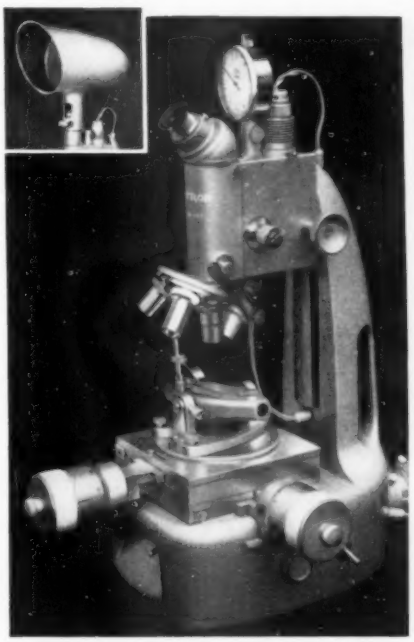
Plug Gages

Threaded precision plug gages, called Jo-Plugs, simplify inspection and setup procedures for checking dimensional accuracy of threaded hole centers. The gage consists of a threaded plug base and an upper spindle called a Jo-spindle. These spindles act as a constant throughout the entire range of plug sizes and are a uniform 0.200-in diam.

To check center distances, proper size



MEASURE TO 0.0001" IN 3 DIMENSIONS WITH UNITRON'S TOOLMAKERS MEASURING AND METALLURGICAL MICROSCOPE



The UNITRON Model TM is more than just a measuring microscope. It is the only instrument which combines in one stand a completely equipped toolmakers microscope for precise measurements — LENGTH, WIDTH and DEPTH, and a metallurgical microscope for examining the structure of polished metal samples under high magnification.

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- **Focusing:** Both dual control rack and pinion coarse and micrometer-screw type fine adjustments. Body has locking device.
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- **Combination Stage:** rectangular ball bearing with linear measurements to 0.0001" and rotary measurements to 5' with vernier. (Metric model available on special order.)
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- **Eyepiece Turret:** available as accessory for measuring surfaces, radii, thread pitch etc.

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plugs are screwed into the holes, allowing the Jo-spindles to act as reference measuring points. By measuring distance between Jo-spindles, and adding the constant (0.200) the checker obtains the distance between centers, within a tolerane of ±0.00015 in.

The gages are available in boxed sets in thread sizes ranging from No. 4 to 1 in., National fine or coarse thread or special thread forms.

Spence Industries, 6910 Chase Rd., Dearborn, Mich. **T-9-11**

Power Deburrers

Smooth, uniform finish on metal, plastic, hard rubber or nylon is obtained in a single pass with the Burrwel power deburrers available in three models.

Model No. 85, illustrated, is a portable unit equipped with carbide cutter and Vee guide which is applied to the edge of a workpiece to make a smooth, continuous 45-deg angle cut from zero to 1/16-in. A special arrangement of the guide fence prevents a secondary burr. Weighing only 5 lb, it can be clamped into a bench vise for small work.

Burrwel No. 175 which weighs about 22 lb, is a larger model of the No. 85. It makes a cut from zero to 1/4 in.

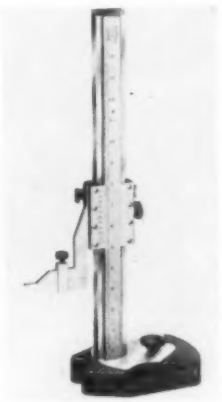
Burrwel No. 200 is an enclosed floor model. It has unlimited capacity on external straight or round edges, and is equipped with a standard carbide cutter and a 60-grit grinding wheel for extremely hard surfaces. An adjustable guide assures proper cutting angle and prevents secondary burrs. Range of this model is from zero to 1/4 in. cut in hard steel.

All three models will deburr and chamfer metal, plastic, rubber or nylon.

Sigwel Corp., 224 Glenwood Ave., Bloomfield, N. J. **T-9-12**

Height Gage

The No. 254 Master vernier height gage facilitates layout and inspection work. It has a 50-division, flush-fitting vernier; full length slide adjustment with quick-adjusting screw release; sturdy, vibration-proof design with natural grip base, fine adjustment knob on base, and provides full range, direct reading. It is available in 12, 18 and 24-in. sizes.



The widely spaced divisions on the vernier plate and half the usual number of graduations on the bar simplify set-

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ting and reading without a magnifying glass.

A quick-adjusting screw release permits rapid adjustment of the slide to approximate setting followed by precise positioning with a fine adjustment knob. Adjusting pressure is against the base, not the bar.

The L. S. Starrett Co., Athol, Mass. **T-9-13**

Drill Head

Adjustable multi-spindle heads accommodate from 2 to 10 spindles in sizes of 7, 10½, 12½ and 15½ in. Bolt circles up to 23-in. diam allow almost any hole pattern to be drilled or tapped within a given circle. Additional spindles can be added.

Spindles are driven by a crank type drive shaft. The shaft of each spindle is

driven by the method used on gearless drill heads of close center design. There are no flexible shafts, universal joints or gear clusters.

Spindle arms can be removed and replaced quickly. The head, which can be used on any standard drill press, is made as a complete unit, with no auxiliary equipment needed.

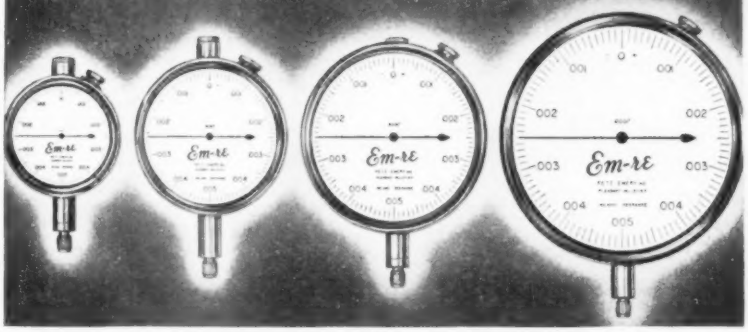
Zagar, Inc., 23892 Lakeland Blvd., Cleveland 23, Ohio. **T-9-14**

Gear Transmission

A combination worm and planetary gear transmission is rated at 225 ft-lb at 8 rpm output. Maximum output torque rating of the Model DS has not been determined, the limiting factor being the characteristic of the lubricant used. A noncorrosive, industrial, extreme-pressure lubricant containing lead naphthanate and sulfurized sperm oil as compounding has given best results during tests.

The heat-treated worm of the Model DS is of high-carbon alloy steel. The

NOW Em-re Dial Indicator Accuracy Available In A Complete Line



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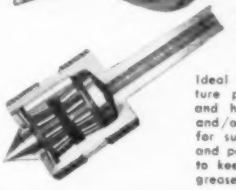

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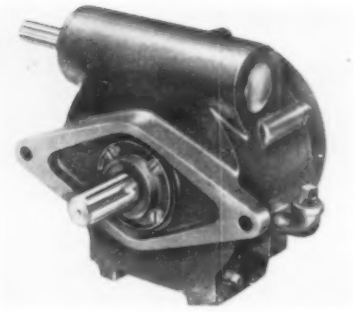
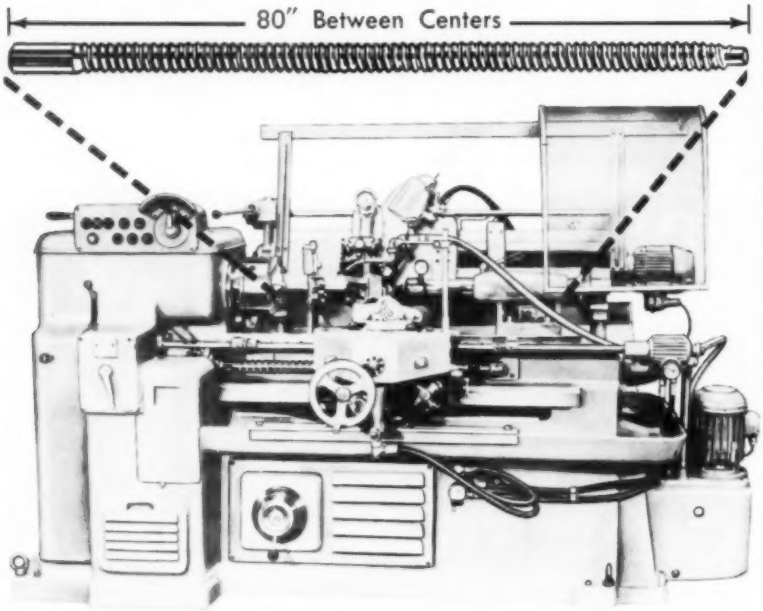


worm gear is of two-piece construction, with the gear portion made with a bronze alloy; the sun gear is cut from an alloyed grey iron casting containing chromium and vanadium. The planet gears are heat-treated steel. The ring gear is cut integral with the grey iron housing for maximum strength.

The unit has a 220:1 ratio, and incorporates a counter-clockwise input and output.

Merkle-Korff Gear Co., 213 N. Morgan St., Chicago 7, Ill. **T-9-15**

NEW Model 3L MAN-AU-CYCLE FEATURES 75" THREADING STROKE



NEW MAN-AU-CYCLE Model 3L THREADS 6' LEAD SCREW* in under 20 MINUTES! — if you thread lead screws or similar pieces *by ordinary methods* you probably require 4 to 7 HOURS to thread a 6' precision screw. Imagine doing the same job in 20 MINUTES!

The NEW Model 3L features 75" thread stroke (80" cc) and a 3" hole in spindle. Not only is it the most advanced and fastest automatic THREADING machine in the world, BUT in addition, it also TRACES, TURNS, FACES, CUTS OFF and BORES . . . all in one simplified chucking operation. Write for the complete MAN-AU-CYCLE story. Do it today and find out how you can combine substantial savings with finished work of superior quality.

* 6TPI, acme thread, 2" diam.

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Engraving Machine

Movement of the engraving head on the worktable of this German-made column type universal engraving machine, Model Gm 1/1, is controlled by a horizontal pantograph. Ratio of the pantograph adjustment can be changed easily from 1:1 to 1:100. By means of existing verniers, any ratio of reduction can be read accurately and set even in decimals. Total lengths of the steering arms for the engraving head also are adjustable.

The swivelling pantograph support speeds operations. It can easily be set to one of three adjusting marks which correspond to ratio 1:1, ratio 1:2 or ratios 1:3 to 1:50—only one adjusting mark is needed for the latter range. Working areas are automatically set to the most convenient position relative to

the table. Four vertical adjustments of the engraving cutter are provided by the engraving head. Vertical, longitudinal and transverse adjustments are provided for the worktable.

With any ratio of adjustment all working areas ordinarily are on the template table without need for its adjustment. For special purposes the table can be pivoted by 90 or 180 deg around its eccentric bearing. Alignment of the template table is by means of an aligning surface on the stand of the machine. A universal template table, which can be used in place of standard type template, allows templates of different widths of profiles and special templates of any width to be clamped securely and quickly without special accessories.

Impex Inc., 3801 Kirby Dr., Houston, Tex. **T-9-16**

Optical Section Comparator

A 14-in. optical section comparator allows inspection of contours of turbine blade edges and the fairing between the edge contour and the foil contour. The

machine incorporates two high intensity illuminating units which produce collimated light. The manually operated blade orienting fixture has an adjustable locating vee and built-in knife edge. Special orienting fixtures also are available.

The collimated light is projected past the knife edge onto the blade held in the locating vee. The straight-line shadow thus formed is inspected, on the viewing screen, as a cross sectional view of the blade edge contour. By moving the blade to and from the lens, the edge contour may be inspected along the entire length of the blade.

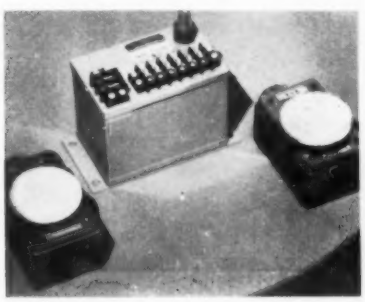
Jones & Lamson Machine Co., Springfield, Vt. **T-9-17**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Safety Interlock

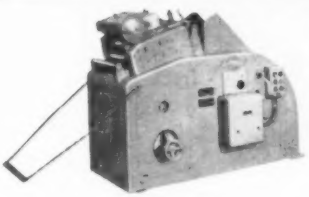
Cypak static safety interlock for machines with dual manual control is available for both new and existing installations. Particularly suitable for application to controls for presses, the magnetic control device contains no moving parts, is compact and tamperproof.

This interlock requires that both palmbuttons or other control switches of a dual-controlled machine to be



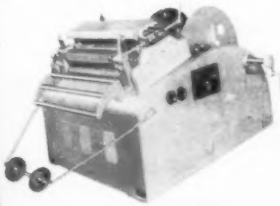
LITTELL

COIL CRADLE-STRAIGHTENER UNITS



No. 408H-C-20
CRADLE-STRAIGHTENER UNIT

Variable Speed Drive for Any Speed, 12 to 72 f.p.m. Cradle holds 2,000 lb. coils. 5-roll straightener handles stock 8" wide x .187" thick. Wider units for 42" wide x .046" thick. Available with Electric Clutch and Brake or with Oil Gear Drive. Some models of this size and type in stock for immediate delivery.



No. 638D-C100
CRADLE-STRAIGHTENER UNIT

Variable Speed Drive For Any Speed From 18 to 108 f.p.m. Air operated Cushion in Cradle eases coils up to 10,000 lbs. into position aligned with straightener head. 5 power-driven straightener rolls handle stock 14" wide x 1.87" thick or 42" wide x .125" in thickness.

SEE OUR CATALOG IN SWEET'S

HOLD Heavy Coils In Small Space

ALIGN Coil With Straightener

STRAIGHTEN At Any Speed

AUTOMATE All These Functions

All Standard Littell Cradle-Straightener Combinations have 6 to 1 Variable Speed Drives to supply straightened stock evenly at any speed within their range. Arm loop control automatically keeps proper slack in straightened stock moving to using equipment. Cradles handle any I.D. coils.

For High Speed — Sudden Stop Operation, an Electric Clutch and Brake can be furnished on the output shaft of the Variable Speed Drive. This feature eliminates starting torque strain. The Variable Speed Drive stays in running position, unaffected by the upward-downward movement of the loop control arm.

Oil Gear Drives can be furnished on these units for extra smoothness and arm controlled straightening speed within a range of 0 to 100 feet per minute.

Delivery is Good from the *larger* Littell Plant equipped to speed production.

USE THIS COUPON
or write for free catalog.

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Chicago 13, Illinois
District Offices: Detroit, Cleveland

F. J. Littell Machine Co.
4199 Ravenswood, Chicago 13, Ill.
Send Littell Coil Cradle-Straightener Catalog Sections "C".

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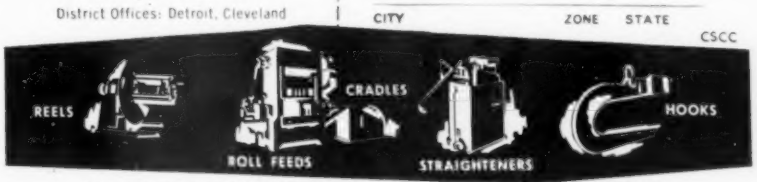
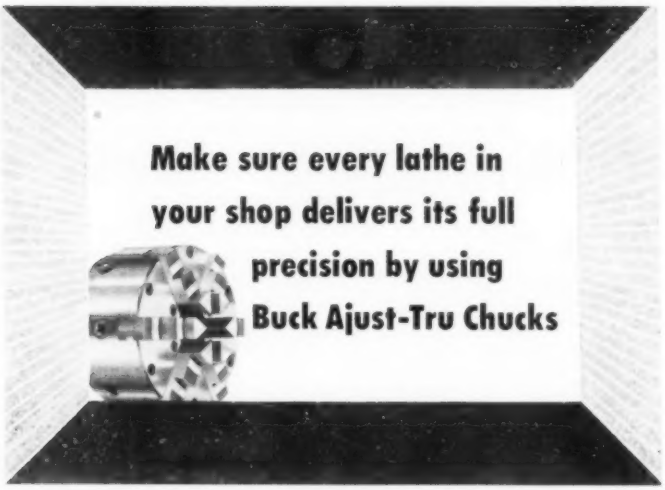


FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-179

THIS-makes *SENSE*



All good lathes today have spindle accuracy to tenths. Conventional scroll chucks are only guaranteed to .003" *when new*.

Since Buck Ajust-Tru scroll chucks provide *dead true* precision — and guarantee .0005" on duplicate parts — they give you *full value* from your lathes.

There is no price premium. A catalog will gladly be sent on request. See why "It pays to chuck with Buck."

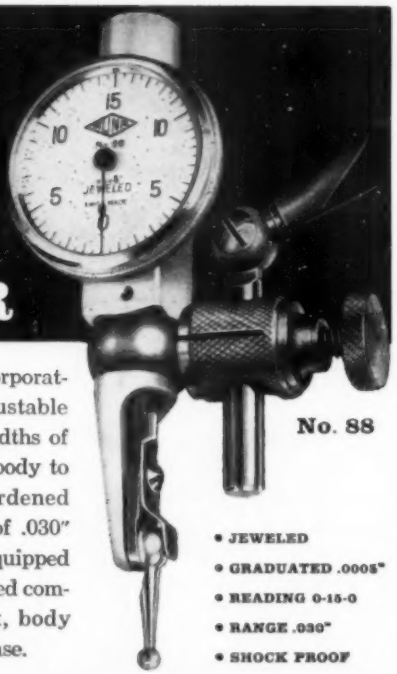
Makers of Scroll, Power, Dust Proof, Independent Chucks, Boring Bars.

BUCK TOOL COMPANY

933 SCHIPPERS LANE • KALAMAZOO, MICHIGAN

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-180-1

ALINA DIAL TEST INDICATOR



No. 88

A fully reversible indicator incorporating a clear easy-to-read, adjustable dial, graduated in half thousandths of an inch, a switch lever on the body to reverse action and TWO hardened chrome plated contact points of .030" and .100" diameter that are equipped with a non-slip ratchet. Furnished complete with a universal shank, body clamp, and plush lined steel case.

- JEWELED
- GRADUATED .0005"
- READING 0-15-0
- RANGE .030"
- SHOCK PROOF

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ALINA CORPORATION

122 East Second St., Mineola, L.I., N.Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-180-2

closed simultaneously. If either button is released, the machine is stopped and can not be restarted until both buttons have been released momentarily and then depressed anew. An operator cannot avoid safety sequencing by taping or shimming control buttons. All critical components are potted and sealed in a steel case.

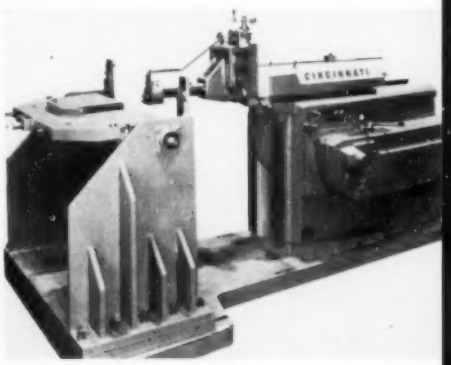
Approximate dimensions of the interlock are 5x6x3 in. Input power requirements are 117 v, 60 cycles; output power is 250 ma at 6.5 v, half-wave d-c.

Westinghouse Electric Corp., P. O. Box 2099, Pittsburgh 30, Pa. **T-9-18**

Shaper

This 16-in. rigid shaper shapes two surfaces, at 90 deg to each other, in an irregular casting. The workpiece is held in a special two-station fixture mounted on the steel base. The fixture replaces the table and rail assembly normally furnished on a shaper.

Because the workpiece is held stationary, the shaper is equipped with a



special cross-travel head that permits cross feeding of the tool. The extended toolholder includes an automatic tool lifter. There is 50 psi pressure lubrication throughout the machine to provide assurance against wear.

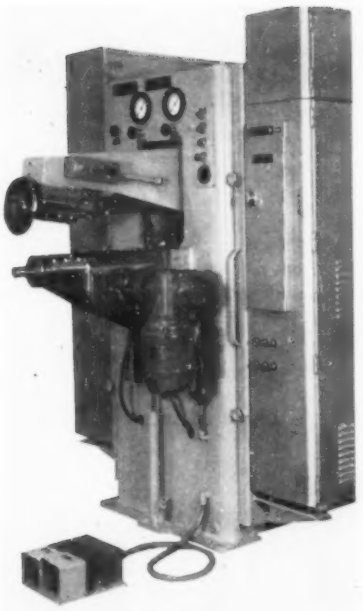
The Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio. **T-9-19**

Seam Welder

A three phase rocker arm type machine resistance seam welds stainless steels of 0.012 through 0.051 in. and titanium to titanium alloys from 0.016 through 0.051 in., to Air Force Navy Aeronautical Specifications.

Firing of the machine is accomplished by a precision differential switch. Drive speeds are steplessly adjusted by a d-c motor drive system mounted to the lower arm. Range of drive speeds is approximately 0.5 to 4 rpm.

The machine has an essentially fric-



tionless constant pressure type air pressure system, with electrode force adjustable from 250 to 2000 lb at 80 psi. The lower arm horn has interchangeable hubs to permit quick change attachment of the proper electrode wheels.

The Federal Machine and Welder Co., Warren, Ohio. **T-9-20**

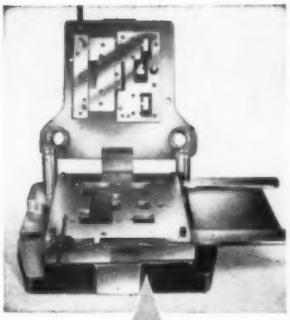
USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Lathe

Designed for turning operations on cylindrical, conical or developed shapes on lightweight pieces of great length and diameter, this lathe is available in semiautomatic and tape-controlled fully automatic models. As a semiautomatic machine, it incorporates a one or two-dimension electronic tracer control for cross slide and carriage. In fully automatic models, cross slide and carriage are controlled by punched tape numerical positioning or magnetic tape contouring control.

Three hardened-and-ground ways support the carriage. On tracer-controlled models, flat templates are mounted on a tee-slotted plate between the outer and intermediate ways.

All functions of lathes are electrically operated. Speeds and feeds are infinitely adjustable and are controlled from a console mounted on an operator's platform attached to the lathe carriage. On varying diameters constant cutting speeds are maintained automatically. Constant cutting feed is maintained by a selsyn feedback system. With this system, in combination with



TOOL LIFE INCREASED 30% OR MORE...

...with miller

200-PLUS

PHOSPHOR BRONZE

*A leading manufacturer of wiring device assemblies reports: "Miller 200-PLUS phosphor bronze, with its great formability, has significantly reduced our need for tool sharpening, and all indications point to a greatly increased tool life. In addition, I get a more consistent part, with more uniform shape and springback."

The secret's in the 200% ductility increase of Miller 200-PLUS. Forming ability goes way up . . . tensile strength remains the same! The result is far less abrasion than with other phosphor bronzes in spring temper—and tools that last one-third longer!

*Name and case history on request

WRITE FOR TECHNICAL DATA

Typical of problem parts that cause abrasion to tool parts is this electric range switch component. Greater formability of 200-PLUS means less abrasion —longer tool life.

miller SINCE 1944

ROLLING MILL DIVISION

THE MILLER COMPANY

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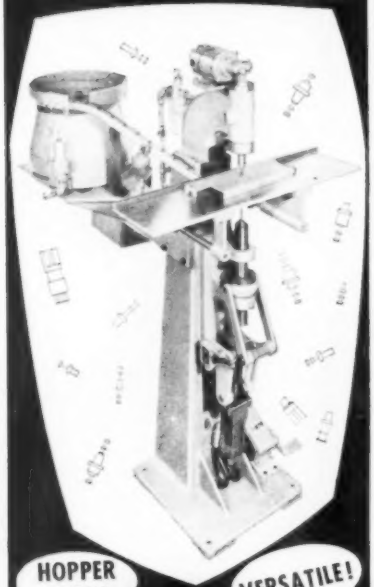
. . . WHERE PHOSPHOR BRONZE IS THE MAIN LINE—NOT A SIDELINE

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-181

TERMINAL BOARD
RIVETER



HOPPER FEED!
VERSATILE!
TIMER CONTROL!
ADJUSTABLE IMPACT!

NEW HILL
SPIN RIVETER

CONSISTENT RESULTS!
LOW MAINTENANCE!
INCREASED PRODUCTION!

Turret terminals of various types and configurations may be hopper fed into the boards from the underside, thus allowing the operator a clear view of the riveting operation. The utilization of the spin rivet feature coupled with adjustable impact and timer control give consistent results. Cracking and splitting of terminals, particularly the stand-off and feed-thru types, has been virtually eliminated.

SEND SAMPLES FOR RIVETING
HILL MACHINE COMPANY
1311 EDDY AVE., ROCKFORD, ILL.
Representatives in Principal Cities
INDICATE A-9-182

pick-off gears, it is possible to cut a wide range of threads.

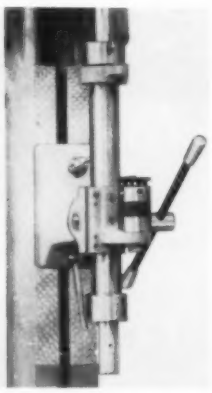
Models are available with up to 96-in. swing over bedways and up to 192-in. length. Spindle, carriage and cross-slide drives are powered by d-c motors with power ratings selected to suit the job requirements. A motor-generator set is standard equipment.

Lucas Machine Div., The New Britain Machine Co., 12302 Kirby Ave., Cleveland 8, Ohio. **T-9-21**

Turret Depth Stop

Multiple drilling operations requiring different depths can be performed on any one spindle without error with this turret depth stop. Because of its simplified operation an inexperienced operator can drill depth competently.

The depth stop is mounted to the front of the sliding arm and has four



positions, each of which can be set for a predetermined depth. By manually rotating to its number position, each preset depth can be repeated accurately as many times as required. Two inches of depth screw adjustment are available in each position.

Edlund Machinery Co., 48 Huntington St., Cortland, N. Y. **T-9-22**

Magnetic Tester

A wet magnetic-particle inspection method—either visible or fluorescent—is employed by the NQ-242 testing machine for production testing of ferrous parts up to 24 in. long.

The suspended magnetizing coil and heads permit conveyorization of parts either through or across the unit. The coil, which pivots and slides along the overhead track, may be positioned between the heads for both longitudinal and circular magnetization of parts, moved to the right for separate coil magnetization, or stored to the extreme left when not in use.

Features of the machine include re-

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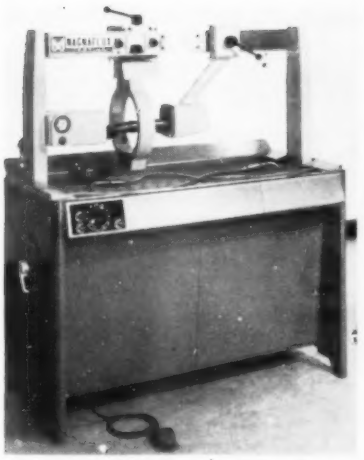


movable and reversible grills, infinitely adjustable current control, and a built-in line disconnect switch.

The unit operates from 220/440 v, 50/60 cycle, 3 phase current. D-C magnetizing output is 1750 amperes through the heads and 6000 ampere-turns through the coil. A-C versions of the same unit are available.

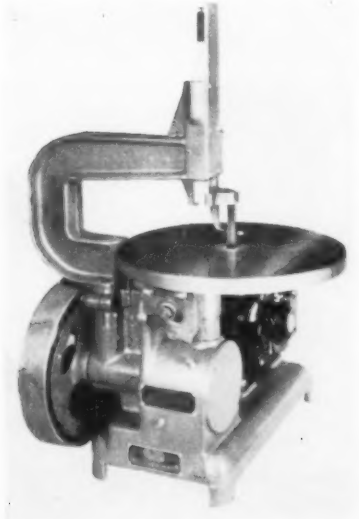
Magnaflux Corp., 7300 W. Lawrence Ave., Chicago 31, Ill. **T-9-23**

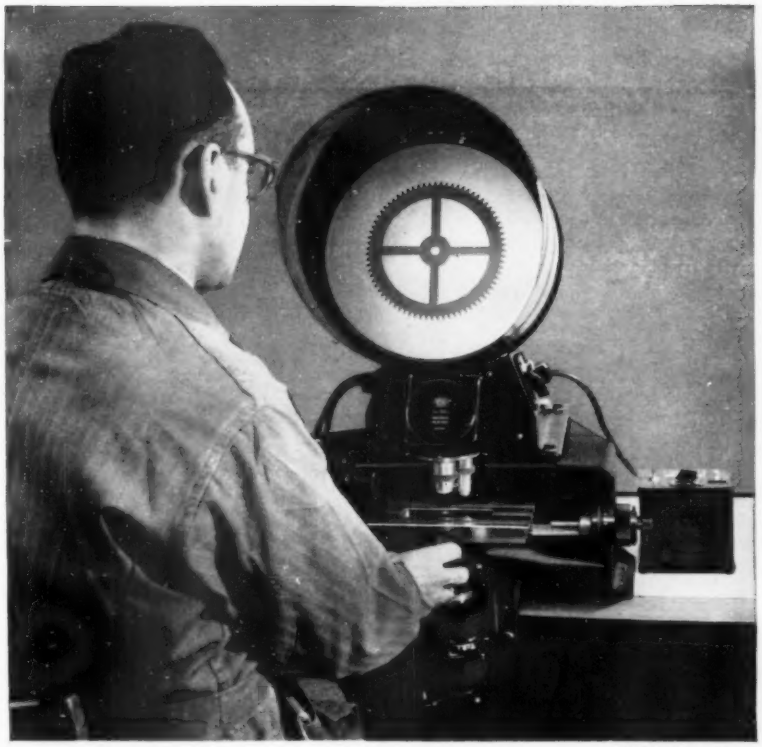
USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Contour Sawing Machine

Any sawing, filing or lapping operation can be handled on this contour sawing and filing machine.

Dies and tools can be shaped to dimension quickly and accurately and do not require hand filing or other semi-finishing operations. The machine is





BENCH MODEL II

this instrument will give you a decided edge in every competitive situation

NIKON OPTICAL COMPARATOR

for critical inspection and measurement of high-precision parts

A small investment, in one Nikon Optical Comparator, will spell enough economies to make a marked difference in your cost-competitive position. One, it will virtually eliminate the need for expensive mechanical gages. Two, it will release trained and skilled personnel for other critical work. And three, it will generally increase the efficiency, speed and accuracy of your quality control operation.

Inspection with the Nikon Optical Comparator is simply a matter of comparing the magnified image of the part under inspection with a master chart or a drawing affixed to the viewing screen. Precise measurements can be made of the most intricate contours—at a glance—by operators with comparatively little training. Further, accurate inspection of surface details and finishes can also be made. Thanks to Nikkor optics, the image is so bright and of such high resolution, that the entire inspection may be carried on in any normally well-lit room. And it can be viewed by several people at the same time.

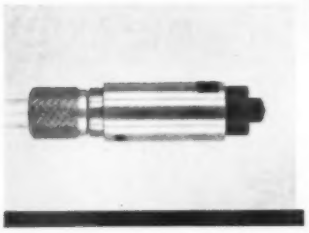
So precise is the Nikon Comparator, that its use has enabled plants to enter into high-precision fabrication, and to achieve tolerances not available by any other methods. The Nikon Bench Model II can be easily carried from one part of the plant to another, for on the spot inspections and measurements, reducing "down time." Photo records of the image can be made in black and white or color.

It will pay you to investigate how a Nikon Optical Comparator can improve the cost-competitive picture of your organization. For complete details, write to: Nikon Incorporated, 251 Fourth Avenue, New York 10, N. Y. Dept. TE-9.

At the ASTE Western Tool Show—Booth 403
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-183

This is a Taft-Peirce Air Capsule shown with No. 9585 Height Gage Stand and Model E CompAIRator Air Gage. The Capsule is an air-actuated, direct contact measuring device that can be substituted for dial indicators in hundreds of shop inspection operations.

NEW
Air Capsule Provides Low Cost Accuracy for Gaging and Quality Control

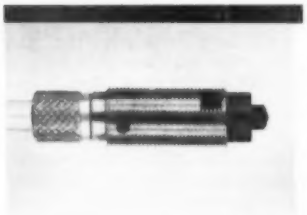


Taft-Peirce Air Capsules measure only 1½" long overall x .375" diameter. The Plain Body Type shown above clamps easily on standard shop measuring tools, or may be built into special gaging fixtures.

From toolroom to transfer line, this new Taft-Peirce Air Capsule creates exciting new opportunities to apply high magnification, visual gaging to all kinds of close tolerance inspection work.

Clamp the Capsule on height gage or surface gage for precise work checking on a surface plate. Substitute it for dial indicators or micrometer heads when designing gaging fixtures. Take advantage of its long-wearing carbide contact point by using it as a sensing device for continuous process inspection.

A Taft-Peirce Air Capsule operates with any CompAIRator Air Gage at any standard magnification, allowing you to spread a few thousandths of an inch over a wide dial expanse, with each graduation equal to a tenth or finer. Available in short range models (0 — .004"), and long range models (.004" — .040"), with plain or threaded bodies. Also supplied with integral 90° adaptors for use where a tight mounting location might cause pinching of air hose.



The Threaded Body Air Capsule is identical with the Plain Body Type, but features extra fine pitch body threads for applications where the Capsule must be critically positioned or moved slightly along its axis at frequent intervals.

No matter what your gaging application may be, a low cost, easy-to-use Taft-Peirce Air Capsule gives you mounting versatility plus all the CompAIRator advantages of high magnification, quick response, outstanding accuracy. Write today for more information.

TAKE IT TO TAFT-PEIRCE

TAFT-PEIRCE MANUFACTURING COMPANY
WOONSOCKET, RHODE ISLAND
FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-184

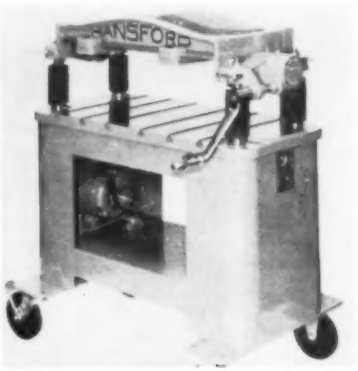
available in five types as a bench or pedestal tool.

Oliver Instrument Co., E. Maumee St., Adrian, Mich. **T-9-24**

Die Handler

Small size die handler, Model 1018, has all-cast construction to assure rigidity and accuracy. Open top platen allows access to the top of a die and any screws entering from the top.

Four lead screw construction with thrust bearings permits off-center pull.



This facilitates separating two-post dies and allows off-center tryout forces up to 1000 lb. Vertical movement is motorized for rapid traverse.

Hansford Mfg. Corp., 1239 University Ave., Rochester 7, N. Y. **T-9-25**

Blind Hole Drilling Tool

An operator can locate hidden parts and drill blind holes with this Blindriller which seeks out a magnet inserted in a hole in the opposite side of the metal.

A slide on the Blindriller is shifted to bring a drill bushing directly over

THE TOOL ENGINEER'S *Service Bureau*

TRADE LITERATURE CURRENTLY OFFERED BY THE TOOL ENGINEER ADVERTISERS

A-9-303—Toolholders—*Adamas Carbide Corp.* Free copy of "Throwaway Tooling Setup and Follow Through" available giving information on Dex-A-Tool. (Page 303)

A-9-108-2—Dial Indicators—*Alina Corp.* Information on Alina Tool Test Indicator given in free literature. (Page 180)

A-9-8—Barrel Finishing—*Almco Queen Products, Inc.* Fifty-two pages of case history facts and descriptions of barrel finishing processes contained in free handbook. (Page 8)

A-9-13—Bushings—*American Drill Bushing Co.* Free catalogs giving information on drill jig bushings. (Page 13)

A-9-262-3—Metal Cutting Machines—*American Pullmax Co.* Free catalog on metalworking ideas describes Pullmax operations. (Page 262)

A-9-12—Radials—*The American Tool Works Co.* Bulletin No. 328 covers information on "American" hole wizard radials. (Page 12)

A-9-204—Hacksaw Blades—*Armstrong-Blum Mfg. Co.* New Marvel catalog and complete story on Marvel metal cutting saws. (Page 204)

A-9-232-1—Automatic Drilling—*Bedford Gear & Machine Products, Inc.* Free catalog and data sheets offer information on precision products. (Page 232)

A-9-69—Cutting Tools—*Besly-Welles Corp.* Catalog 857 gives information on the complete range of standard styles and sizes of tools. (Pages 68-69)

A-9-226-1—Sharpening Machines—*Edward Blake Co., Inc.* Free bulletin gives information on flute grinders. (Page 226)

A-9-270—Surface Grinders—*The Blanchard Machine Co.* Free booklets, "Work Done on the Blanchard" and "The Art of Blanchard Surface Grinding" available on request. (Page 270)

A-9-199—Milling Cutters—*Brown & Sharpe, Cutting Tool Div.* New Nelco catalog shows over 700 "Standard" carbide and carbide-tipped tools. (Page 199)

A-9-180-1—Chucks—*Buck Tool Co.* Buck Adjust-Tru chucks described in free catalog. (Page 180)

A-9-310-2—Vises—*Cardinal Machine Co.* New catalog tells how to save 50 percent on tooling costs with simple jigs in a speed vise. (Page 310)

A-9-236—Shapers—*The Cincinnati Shaper Co.* New catalog N-7 gives information on Cincinnati Rigid shaper. (Page 236)

A-9-222—Gages—*Arthur A. Crafts Co., Inc.* New 8-page carbide gage catalog available with coupon. (Page 222)

A-9-266-2—Die Cushions—*Dayton Rogers Co.* Full universal pneumatic die cushion described in Catalog F-44-A. (Page 266)

A-9-212—Press Feeds—*H. E. Dickerman Mfg. Co.* Free literature on complete Dickerman standard press feed line. (Page 212)

A-9-167—Photography—*Eastman Kodak Co.* "Magnifying Time" shows how high-speed movies can solve your performance problems. (Page 167)

A-9-207—End Mills—*Eclipse Counterbore Co.* Complete information given on Eclipse exclusive design end mills in Catalog E 57 M. (Page 207)

A-9-282-3—End Mills—*M. A. Ford Mfg. Co.* Full range of diameters in solid carbide end mills described in Bulletin 601. (Page 282)

A-9-32—Tracer Mill—*George Gorton Machine Co.* Complete information on hydraulic tracer control duplicators in Bulletin 2771-2609. (Page 32)

A-9-223—Comparators & Gages—*Hanson Whitney Div. of Whitney Chain Co.* Complete line of thread comparators and assistance on all threading and gaging problems given in catalog. (Page 223)

A-9-5—Lathes—*Hardinge Bros., Inc.* Bulletin HLV describes toolroom and production lathe features. (Page 5)

A-9-177-2—Live Centers—*Ideal Industries, Inc.* Complete data and specifications on Gold Band live centers in new catalog. (Page 17)

A-9-58—Collets—*Jacobs Mfg. Co.* Information on Model 96 Key type and Model 91 handwheel collet chucks given in Bulletins 57 CC and 57-LC. (Page 58)

A-9-225—Chucks and Collets—*McCrosky Tool Corp.* Fully descriptive catalogs give information on the complete McCrosky line. (Page 225)

A-9-240—Carbide Tools—*Metal Carbides Corp.* Seventy-six-page catalog 56-G describes special shapes and sizes of various tools. (Page 240)

A-9-276—Gear Finishers—*Michigan Tool Co.* Descriptive literature on Universal 870-A gear finisher. (Page 276)

A-9-181—Phosphor Bronze—*Rolling Mill Div., The Miller Co.* Technical data on Miller 200 plus phosphor bronze available. (Page 181)

A-9-233—Hydraulic Cylinders—*Miller Fluid Power, Div. of Flick-Reedy Corp.* Bulletin JH-104 N gives complete data and helpful charts on column strength cylinder forces, factors of safety, acceleration pipe pressure losses, etc. (Page 233)

A-9-46—Subland Drills—*Mohawk Tools, Inc.* Free brochure entitled "Why Use Two . . . When One Will Do" gives ideas and suggestions on drilling. (Page 46)

A-9-198—Rotary Table—*Moore Special Tool Co., Inc.* Bulletin RT2 gives information on precision spacing applications on jig borers and grinders. (Page 198)

A-9-239—Gear Honing—*National Broach & Machine Co.* Bulletin H-57-2 shows how hazards of gear manufacturing are overcome by honing. (Page 239)

A-9-291—Honing—*National Pioneer, Inc.* Free literature and specifications available on speed, economy and consistency in honing operations. (Page 291)

A-9-206—Automatic Equipment—*A. H. Nilson Machine Co.* Nilson General Catalog available on automatic 4-slide equipment. (Page 206)

A-9-238-2—Jig and Fixture Components—*Northwestern Tools, Inc.* New 16-page catalog and tracing templates for jig and fixture components and clamping tools is now available. (Page 238)

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A-9-281—Machine Tools—*Olivetti Corp. of America, Machine Tool Div.* Illustrated 22-page catalog gives information on high precision grinding machines, traverse grinding and plunge grinding. (Page 281)

A-9-263—Hydraulic Cylinders—*Ortman-Miller Machine Co.* New Bulletin 105 gives detailed information on heavy-duty hydraulic cylinders. (Page 263)

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A-9-308—Holding Tools—*Scully-Jones & Co.* Free literature describes how "Optimation" is applied and forms for analyzing minimum cost tool life. (Page 308)

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A-9-63—Cutting Oils—*Sinclair Refining Co. Technical Service Div.* Free literature tells how to increase tool life and cut cost. (Page 63)

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A-9-165-2—Tumble Jigs—*Standard Parts Co.* Free tumble jig bulletin describes details of new "Tumble" box jig. (Page 165)

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A-9-57—Honing Tools—*Sunnen Products Co.* "Typical Applications" honing booklet describes 105 typical applications. (Page 57)

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A-9-283 — Grinders — *The Thompson Grinder Co.* Catalog T-558 gives information on Thompson Truforming grinders. (Page 283)

A-9-4—Jig Grinder—*Threadwell Tap & Die Co.* Complete information available on "Grind-a-matic" versatile grinding head. (Page 4)

A-9-274—Steels—*Uddeholm Co. of America.* Tool Steel Stock List No. 12 now available. (Page 274)

A-9-175—Microscopes — *Unitron, Instrument Div. of United Scientific Co.* Bulletin TM describes Unitron's tool makers and metallurgical microscope. (Page 175)

A-9-196—Machine Attachments — *United States Drill Head Co.* Adjustable U S drill heads described in Catalog AD-57. (Page 196)

A-9-282-2—Special Machines—*The Vaill Engineering Co.* Bulletin T-1 describes Vaill Tube end forming machines. (Page 282)

A-9-162—Cutting Tools—*Vascoloy-Ramet Corp.* Details, specifications and dimensions on complete list of carbide, ceramic and tantung cast alloy cutting tools given in new Catalog VR-58. (Page 162)

A-9-259—Spring Plungers—*Vlier Engineering Co.* 1957 catalog lists all sizes and types of standard and special spring plungers. (Page 259)

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A-9-191—Grooving Tool—*Waldes Kohinoor, Inc.* New 20-page manual gives information on Waldes Truarc grooving tool. (Page 191)

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A-9-292-1—Abrasive Cutting Machines—*Wallace Supplies Mfg. Co.* Free 44-page Wallace-Cut-Machining book available. (Page 292)

A-9-210—Spindles—*The Whitnon Mfg. Co.* Free literature gives engineering specifications on Whitnon high-frequency electric spindles. (Page 210)

A-9-190—Drill Heads—*Wisconsin Drill Head Co.* Catalog shows line of products for drilling and tapping. (Page 190)

A-9-288-4—End Mills—*Woodson Tool Co.* Free catalog listing micro miniature end mills in stock sizes. (Page 288)

A-9-193-1—Tube Mills—*The Yoder Co.* Full details on advantages of using Yoder equipment given on request. (Page 193)

A-9-168—Microscopes—*Carl Zeiss, Inc.* Free detailed specifications on Zeiss scientific instruments given on request. (Page 168)

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the hidden hole. The bushing guides a drill in matching the hidden hole to within 0.005 in. concentricity.

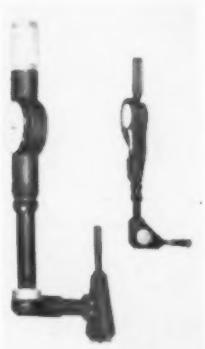
The tool locates concealed nails, conduits and other installations without use of a magnet. It can also be used to locate layout points from opposite surfaces, to speed up template reproduction, and to find the proper drilling position for "knock-out" holes to remove broken drills.

Zephyr Mfg. Co. Inc., 201 Hindry Ave., Inglewood, Calif. **T-9-26**

Right Angle Dial Bore Gage

For conditions which provide limited clearance, this right angle type dial bore gage is useful for measuring work in jig borers, internal grinders and horizontal boring mills. It also may be used at subassemblies in which there is restricted access to the borers.

Six sizes of this type gage cover an overall range from $\frac{3}{8}$ to $6\frac{1}{8}$ in. In



addition to individual sizes, sets are available comprising a single dial unit and two interchangeable heads covering together $\frac{3}{8}$ to 1 in.

Standard Gage Co., Inc., Poughkeepsie, N. Y. **T-9-27**

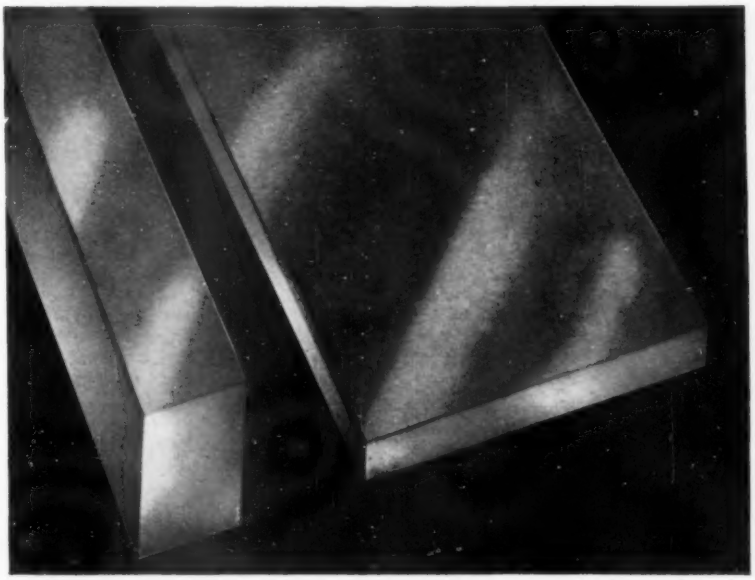
Three Dimensional Router

Equipped with tracing control, stationary table to provide for large overhanging workpieces and an enclosed power unit, the Hydro-Router combines a tracer valve and precisely accurate adjusting assembly.

The three dimension tracer valve comprises three individual high-precision 4-way metering valves, two of which are mounted in a horizontal plane, and one mounted perpendicular to the horizontal plane. All three valves are manifold joined to comprise a single valve actuated by a single stylus. The valve is designed to permit easy disassembly and routine maintenance to any one or all three directional components. Tracing feed rate is infinitely adjustable.

The Turchan hydraulic power unit used in conjunction with the Hydro-Router has a two-chamber reservoir capacity of 60 gal with provisions for adequate filtering and settling of the hydraulic oil. Two independent pumps assure an adequate volume when all three saddle and ram movements of the machine are operating simultaneously. The hydraulic circuit provides for a separate supply of oil for both the vertical movement of the ram and the combined horizontal movements of the saddle and ram.

The three-way micrometer adjusting assembly on the Hydro-Router, constructed positive stability, has double crank compound rest type handwheels



New Lamina Wear Plates Last Longer, Cost Less!

Now . . . save money and get better performance wherever you have sliding contact between flat metal parts! The principle of bronze electroplated on a steel backing originated with Lamina Bronze-Plated Guide Pin Bushings. Proven during countless millions of punch press hits, it is now being used successfully to produce flat wear plates.

This new concept in wear plate design combines the low cost, ready machinability and solid backing of steel with the long-wearing, non-seizing, free-running properties of a copper-tin bronze alloy. Lamina Bronze-Plated Wear Plates are flat, parallel, and can be easily machined to suit your application. Standard sizes available from stock. End costly wear problems and reduce expensive downtime now! Write for complete information.

Lamina
DIES AND TOOLS, INC.
P.O. BOX 31, ROYAL OAK, MICHIGAN

Manufacturers of Lamina Guide Pins, Bronze-Plated Bushings, Progressive and Lamination Dies

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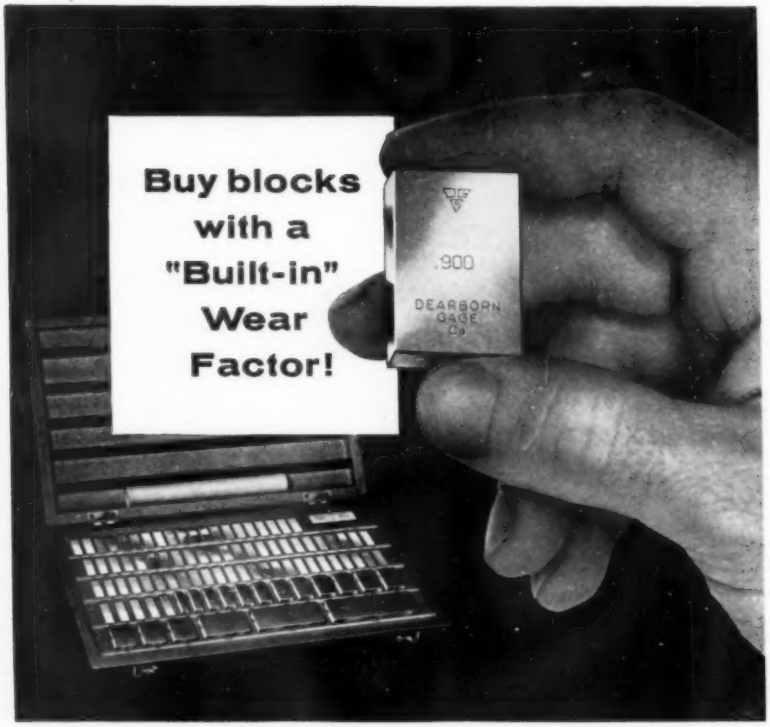

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Here at last are gage blocks with a positive "built-in" wear factor! The only blocks ever produced and priced as standard with dimensional accuracy unconditionally guaranteed to be within specified millionths on the "plus" side of nominal block size and minus "zero" . . . absolutely nothing . . . undersize!

This complete elimination of the conventional minus tolerance gives you, the gage block user, three new and exclusive benefits. First, it provides positive assurance against receiving new blocks that are actually "worn" undersize during manufacture before they are ever used. Second, it gives you finer, more practical accuracy . . . with the sure knowledge that every Ellstrom block you buy will start wearing *toward* its nominal size rather than *away* from it. And third, it gives you a guaranteed minimum wear factor equivalent in millionths to the full minus tolerance specified as standard for all other makes of blocks!

Write for descriptive literature containing complete price information today!

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"I"—INSPECTION ACCURACY BLOCKS
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Parallelism: .000003" Flatness: .000003"

"L"—LABORATORY ACCURACY BLOCKS
Measured Length: +.000002"/−.000000"
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Ellstrom—your best buy in gage blocks for shop and tool room use, inspection and laboratory applications. Available in 28 standard sets ranging from 8 to 92 blocks in both square and rectangular styles with or without basic gage block accessories.

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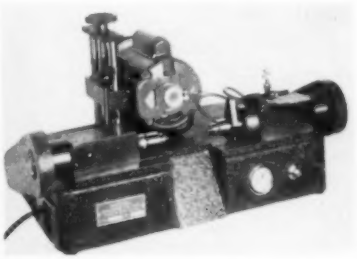
with dials readable in 0.001 in., replaceable bronze nuts for all screw movements, and $\frac{5}{8}$-in. diameter Acme thread screws.

Turchan Follower Machine Co., P. O. Box 6055, Dearborn 9, Mich. **T-9-28**

Deburring Machine

Deburring both sides of holes from $\frac{1}{32}$ to $\frac{1}{2}$-in. diam is possible on this opposed spindle bench machine. Because spindles rotate in opposite direc-



tions, there is no cutter torque—hand feeding is thus both safe and easy.

The machine is foot controlled and spindle is air operated, leaving both the operator's hands free to feed the deburring machine.

Model Machinery Co., Inc., 4729 Hawthorne St., Philadelphia 24, Pa. **T-9-29**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Testing Machine

Mechanical properties of materials can be determined over temperature ranges extending to 3000 F by this Model TM-1 testing tool, which provides

automatic simulation for a wide range of stress and strain at elevated temperatures. With a capacity of 0 to 50,000 lb, the universal machine handles tests of tension, compression, creep, fatigue, etc., on full-size ASTM specimens.

Electronically controlled servos automatically subject the specimens to any combination of rates of loading,

elongation and temperature. Ram rates of up to $\frac{3}{4}$ ips, temperature rises of 200 deg per second, and cyclic rates of 10 cycles per second, are possible. Measurements of strain and load are automatically plotted, providing a complete stress-strain curve on a single $8\frac{1}{2}$ x 11 graph.

Marquardt Aircraft Co., Special Products Project, Dept. 75, 16555 Saticoy St., Van Nuys, Calif. **T-9-30**

Lathe Chuck Wrench

Fifteen different sizes of this socket chuck wrench are made to fit various types and sizes of standard lathe chucks. In addition, an L-handle spinner wrench, available in two sizes, provides the lathe operator with more lev-

erage, less weight, and faster operation of his chuck, when used with the socket chuck wrench. The chuck wrench also can be used with a ratchet wrench, or any other standard wrench, with $\frac{3}{8}$-in. square male drive.

PowerGrip, Inc., 25 George St., Wallingford, Conn. **T-9-31**

Oven Units

Infrared heating modules with housings that can be stacked into any layout to meet variable heating requirements give immediate, even heat and require minimum maintenance. Elements are of formed resistance wire and there are no bulbs or tubes. Their radiation heats all colors and surfaces of material equally well.

The heating module is made up of a sheet metal shell, a formed resistance wire heating element, a ceramic diffusion face and alternate layers of high-temperature batt and reflective insulation. A similar module is supplied which has a stainless steel reflector face instead of the heating element and its facing material. This reflects stray rays back to the work and forms a part of the oven structure where heating modules are not needed. It can also be used as a barrier between different temperature zones in an oven.

Handles on the back of the modules allow for stacking and rearranging from the outside. Conduit ducts on the outside of the module contribute to oven rigidity. Heating modules measure 2 ft x 1 ft x 6 in., have three power outputs: 3, 2 and 1 kw. Temperature is up to 1500 F at the module base.

Infrared Systems, P. O. Box 1, Pompton Lakes, N. J. **T-9-32**

Contour Polisher

Contours in several planes can be polished with this equipment which consists of Model DLS abrasive belt head unit and the Job-O-Matic Jr. worktable, designed especially for polishing contours, but equally useful for flat work. The abrasive belt head unit is able to perform both slack-belt operations and jobs requiring the backing up of the belt with either a contact wheel or platen.

Model DLS will accommodate motors up to 5 hp and 132 in. length abrasive belts up to 4 in. in width. Belt tension is adjusted and maintained by an air cylinder on the tracking pulley.

Wide spacing between the two idler pulleys on either side of the contact wheel permits polishing of radical contours. Various controls, accessories and optional alternate arrangements are available.

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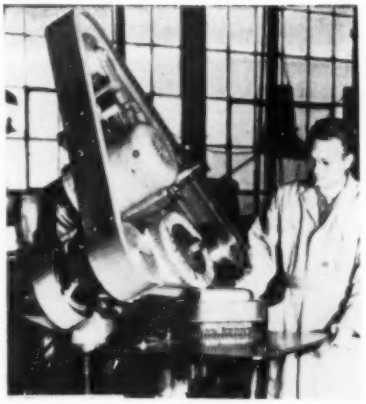
floating spindle head units, many contours can be polished in one plane. Substitution of the DLS abrasive head unit for a conventional head makes it possible to cover contours in another plane.

The Job-O-Matic Jr. incorporates adjustable speed drive in the 8 to 1 range; 24 x 30 in. table top and a ½ hp motor. Height from floor to table top is 36 in. Various types of control to either standard or JIC electrical specifications are available.

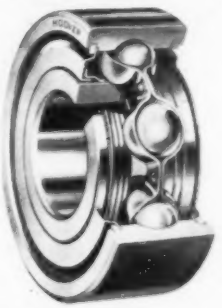
If automatic cycle control is employed, pressing the cycle start button will initiate the processing of each piece of work; at the end of the time cycle the machine stops automatically for reloading. Both mechanical and vacuum chucking arrangements are available.

Divine Brothers Co., Seward Ave., Utica, N. Y. **T-9-33**



Ball Bearings

Cartridge ball bearings are constructed to hold a lifetime supply of lubricant and also employ a slinger action to circulate the lubricant. Designed to standard double row bearing widths, the bearings have large reservoirs to hold the factory-applied lubricant. Dual labyrinth seals, which lock in the lubricant, are formed by an inner and outer shield, fitted to create both a horizontal and vertical labyrinth. Running tolerances are so close that lubricants cannot escape or dirt enter the bearing. The inner shield, rotating with the inner raceway of the bearing, provides the centrifugal force that continuously returns lubricant to the working surfaces, regardless of bearing position. Bore and outside diameters are the same as standard single row bearings.



Hoover Ball and Bearing Co., Ann Arbor, Mich. **T-9-34**

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Bench Center

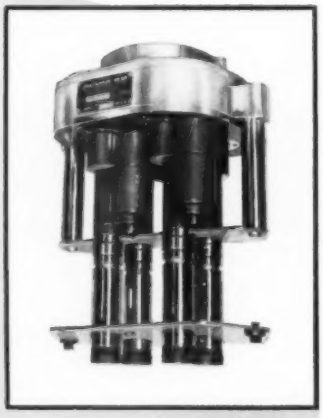
This bench center is used for checking concentricity, runout and squareness of face to axis, or outside diameter of miniature and subminiature parts and components.

The instrument bench center designated No. 9205M, has a two-way design which checks small work on the centers either horizontally or vertically. A self-aligning shaft makes it possible for the workpiece to be set in place quickly and accurately by loosening a single locking knob and sliding the tailstock along the aligning shaft. When the tailstock locking knob is tightened, the cen-

FAST Precision SET-UPS

that "Stay Put" because they are Secured by Locked Templates*

★This exclusive patented feature, found only in Wisconsin Adjustable Drill Heads, assures accurate set-ups.



1. Positioning template for primary adjusting is placed on the support posts. Using a spanner wrench as shown, the spindles are quickly swung into position, locating in the half-holes, which are accurately jig-bored for the required hole pattern.

2. The locking template . . . with full holes bored to match . . . is then slipped over the spindles. Then both plates are secured to the support posts, and individual spindle locknuts are tightened to lock each spindle.

Wisconsin builds Adjustable and Fixed Spindle Drill Heads and Tapping Heads, Lead Screw Tapping Units, Special Machines, Fixtures, Fixture Bases and Index Tables.

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WISCONSIN DRILL HEAD CO.

4985 N. 124TH STREET • BUTLER, WISCONSIN

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ters line up automatically.

The portable equipment can be setup quickly on a surface plate for handling any work, up to 8 in. long and 3 in. in diameter. When used on an accurate surface plate, the centers line up alike for height and parallel to the surface

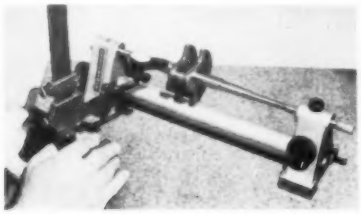
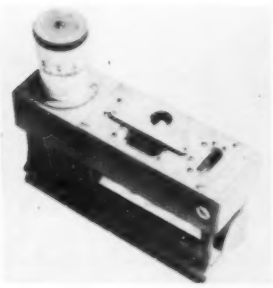


plate within 0.0002 in. When mounted vertically, on headstock pads, the work axis is square with the surface plate within 30 sec of arc.

The Taft-Peirce Mfg. Co., Dept. FHC, Woonsocket, R. I. **T-9-35**

Optical Level

Critical leveling and measuring operations for flatness, straightness and parallelism can be performed accurately with the optical level which quickly indicates deviations from the horizontal of 0.00012 in. per foot of length or 0.00001 in. per inch of length. Amount



and value of deviation from the true horizontal are measured by a graduated micrometer thimble and barrel with easily read markings. The 7-in. long optical level is easy to operate.

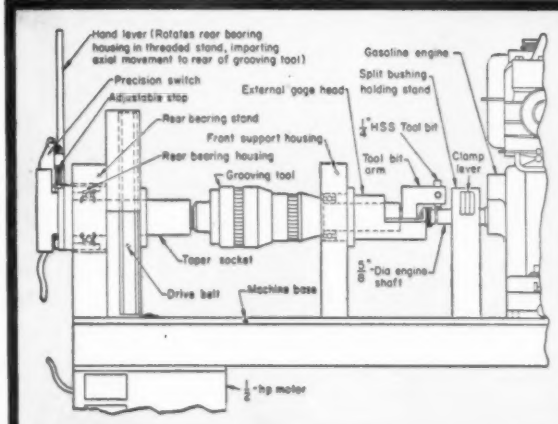
F. T. Griswold Mfg. Co., 315 W. Lancaster Ave., Wayne, Pa. **T-9-36**

Band Sawing Machines

Line of 16 and 30-in. band sawing machines combine compact, flexible design of the earlier SFP series with power, strength and stamina of standard, heavy-duty contour machines.

Accuracy is assured, even under heaviest cuts, by the heavy toolpost and toolpost guide. A Speedmaster adjustable speed drive delivers full output of the one horsepower motor to the cut

Groove cut in shaft of fully assembled engine with WALDES TRUARC GROOVING TOOL



U. S. PAT. 2,411,426

To install a small gear, Clemson Bros. must machine a recess (Tolerance: +.033" —.000") in a shaft of the engine for their power lawn mowers.

Engines arrive fully assembled. Normal procedure was to rotate the shaft. That involved removing a spark plug, mounting each engine firmly and accurately on a lathe, securing a gear or sprocket on the shaft, driving the shaft and moving the stationary cutting tool into position. The engine had to be reassembled after grooving.

All this costly time and labor was eliminated by holding the shaft stationary and *using a tool that rotates*—the Waldes Truarc Grooving Tool, equipped with an external grooving attachment. Because grooving dimensions are pre-set on the tool, there are no rejects caused by inaccurate cutting.

No recessing problem is too tough for this amazingly versatile tool. It's so simple, even unskilled labor can use it accurately...so cost-saving, it often pays for itself on a single small run!

Write now for 20-page manual containing full information on Waldes Truarc Grooving Tool. TE 090

WALDES

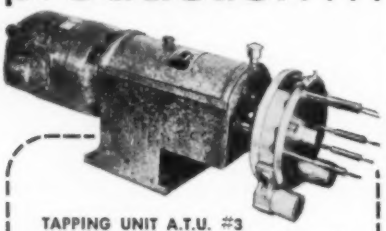
TRUARC®

GROOVING TOOL

WALDES KOHINOOR, INC.
47-16 AUSTEL PLACE, L. I. C. 1, N. Y.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-191

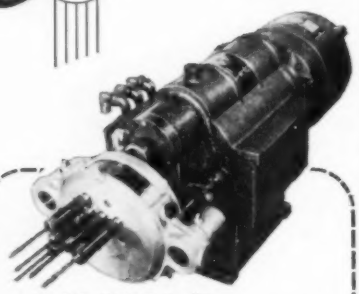
The Tap and Drill Team for your hole production . . .



TAPPING UNIT A.T.U. #3

Completely self-contained all-electric lead screw precision unit. Quickly interchangeable for fast single or multiple spindle head operation. With forward and reverse electro-magnetic clutches and variable torque control.

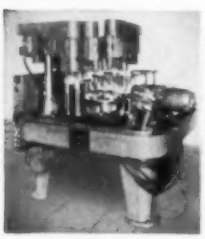
Ettco-Emrick **TAP & DRILL TWINS**



DRILLING UNIT D.U. #2

Completely self-contained precision unit with powerful air feed and hydraulic control. Quickly interchangeable for fast single or multiple spindle head operation.

Used singly or in combination they offer the flexibility and adaptability to meet modern drilling and tapping requirements. When combined with Ettco-Emrick multiple spindle heads they'll set new standards of precision, speed and economy.



SPECIAL MACHINES

Building the Twins into high production special machines is simple, because all units are electrically controlled and all components are standardized equipment. We can supply the assembly complete with tooling — or you can do it in your own plant.

Write for details

Authorized distributors in U.S. and Canada

ETTCO TOOL & MACHINE CO., INC.

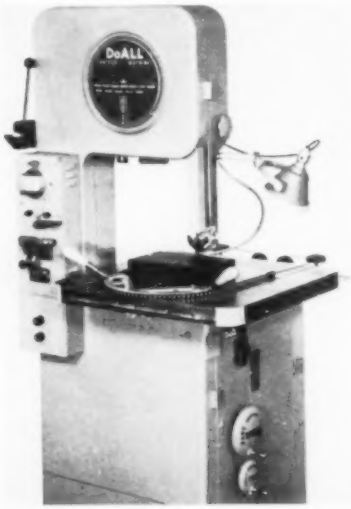
602 Johnson Avenue, Brooklyn 37, N. Y.

Chicago • Detroit • Los Angeles • Indianapolis

The only full line manufacturer covering the entire small hole field: Tapping Attachments • Multiple Heads • Drilling & Tapping Units and Machines • Special Machines • Indexing Fixtures • Tap & Drill Chucks

INDICATE A-9-192

throughout the entire 50 to 5200 fpm band speed range. This permits the Model 16M and 30M to contour saw any machinable material, as well as band file, band polish and friction saw thin ferrous work. The start-stop switch, feed, speed change and band tension handwheels, and the band tension indicator have all been sized and positioned



for operator convenience and ease of operation.

Built-in band shear and welder permit internal cutting.

A deep throat accommodates large jobs that are routine in sheet metal shops and frequently encountered in maintenance shops.

The DoAll Co., Des Plaines, Ill.

T-9-37

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Processing Barrel

A horizontal barrel door that opens and closes automatically is a feature of the metal processing barrel for cleaning, phosphating, blackening, Lubrite, Bonderizing, chromate treatments, pickling and similar processing.

After the barrel is loaded, a signal starts it rotating. Rotation actuates the mechanism that closes the door, which is held secure by a detent spring while the barrel passes through the treatment cycle. On completion of the treatment, barrel rotation is reversed to open the door and discharge the load.

The barrel can easily be integrated into automated processes as it is adaptable to automatic hopper feeding and automatic unloading to hoppers or conveyor belts.

The equipment is capable of handling

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SHRINE EXPOSITION HALL

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For more information, write:

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DETROIT 38, MICH.

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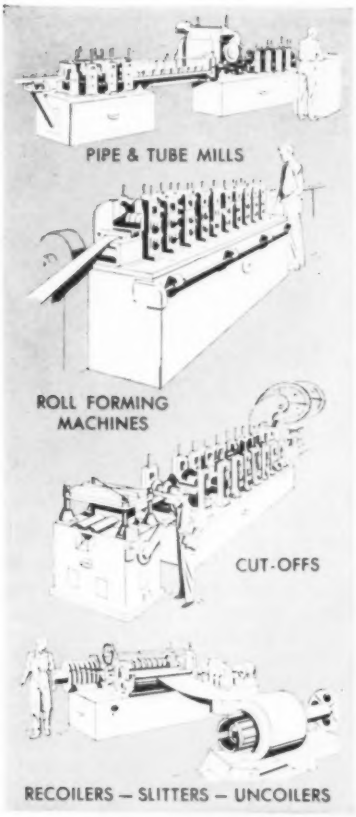
TOOL SHOW CONFERENCE '58 SEPT 29 - OCT 3



YODER MAKES THEM ALL

. . . Complete equipment lines for heavy or light production!

Uncoilers, slitters, roll-forming machines, cut-offs, pipe and tube mills, special machinery for ferrous or non-ferrous metals are all made and engineered by Yoder to fit your specific requirements.

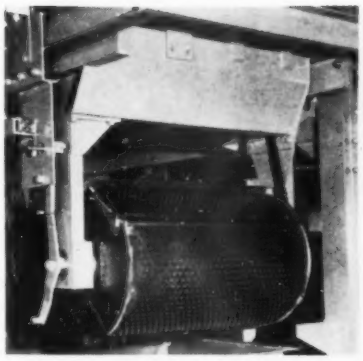
Special attachments and auxiliary units can perform additional operations such as welding, coiling, punching or embossing without extra labor cost while increasing production speed.

Let Yoder engineering and "know-how" help you get the most from your plant . . . with Yoder equipment. For full details, write to:

THE YODER COMPANY
5525 Walworth Ave. • Cleveland 2, Ohio

ENGINEERING YODER MANUFACTURING
PIPE AND TUBE MILLS (ferrous or non-ferrous)

INDICATE A-9-193-1



heavy loads of large or small parts. Its size and configuration can be tailored to individual requirements. Barrels may be chain, belt or gear driven.

Hanson-Van Winkle-Munning Co., Church St., Matawan, N. J. **T-9-38**

Metal-Cutting Computer

Evaluation of metal-cutting conditions is possible with a portable computer called the Cutmeter. This instrument puts into convenient form the relationships of feed, speed, depth of cut,

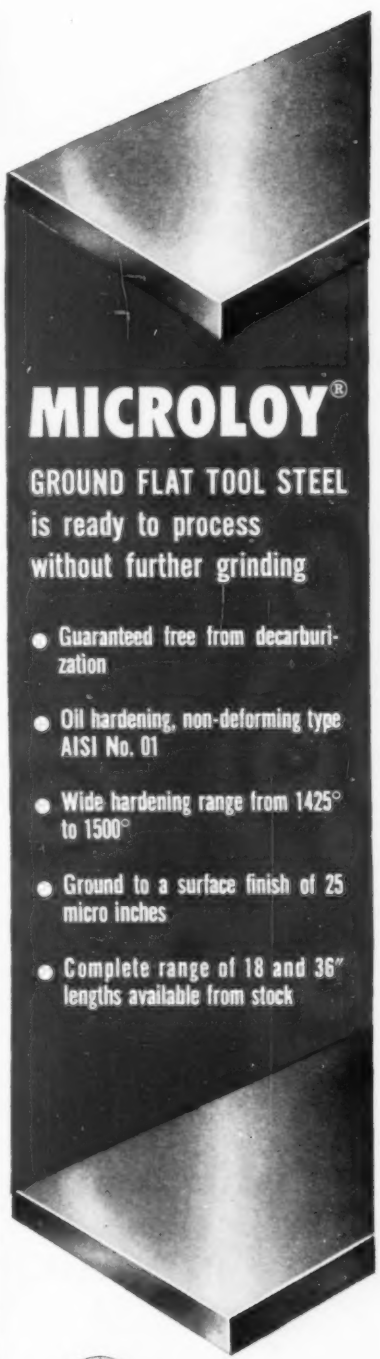
power, etc., which have been established through metal-cutting research.

Practical feeds and speeds for starting a job are quickly obtained by direct setting of the dials. For more detailed recommendations, charts are provided for adjusting to unusual tool geometry or wear limits. The device also can be used for establishing machining practices on new operations.

Kennametal Inc., Latrobe, Pa. **T-9-39**

Disintegrator Head

Developed for removing broken taps, drills, etc., this electromagnetic disintegrator head has no springs, drive pins, fiber pads, helical copper coils or solenoids. The head has controlled drive and lift power for large electrodes or deep hole drilling, and unusually sensitive vibration control for electrodes with


MICROLOY®
GROUND FLAT TOOL STEEL
is ready to process
without further grinding
• Guaranteed free from decarburization
• Oil hardening, non-deforming type AISI No. 01
• Wide hardening range from 1425° to 1500°
• Ground to a surface finish of 25 micro inches
• Complete range of 18 and 36" lengths available from stock

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CAPEWELL

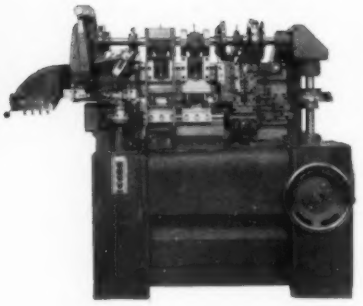
THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.
INDICATE A-9-193-2

THE FIRST

ENTIRELY NEW

FOUR-SLIDE IN

FIFTY YEARS!



A development of industry-wide importance is the Torrington Verti-Slide—a new vertical 4-slide that is the first major innovation in the basic field of wire and strip forming equipment in half a century!

The Verti-Slide was designed to meet a serious need for greater versatility, lower tooling cost, faster set-up time and reduced floor space. We urge you to investigate the new Torrington Verti-Slide in detail.

THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT • VAN NUYS, CALIFORNIA • OAKVILLE, ONTARIO

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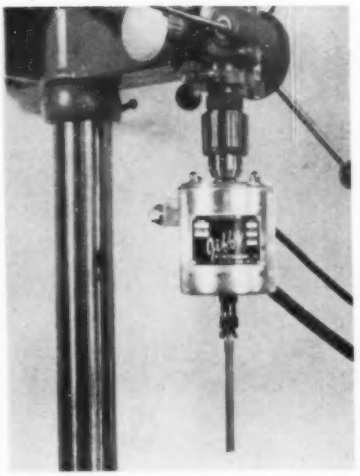

0.008 or 0.010 OD. Moving parts have been minimized to avoid wear trouble.

This disintegrator head, which is adaptable to any disintegrating machine, will operate properly while completely submerged in water.

Jiffy Disintegrators, Inc., 109 E. Nine Mile Rd., Detroit, Mich. **T-9-40**

Low Carbon Flat Stock

No. 498 low-carbon precision ground flat stock has a machinability rating of 91 percent. An 0.18 carbon, fine-grained, silicon-killed steel of forging quality, it is precision ground to the same tolerances as Starrett tool steel ground flat stock. Ends are machined square; edges are ground parallel and square. Thickness is accurate within 0.001 in.

This free-machining low-carbon flat stock is available in 24-in. lengths in widths from $\frac{3}{8}$ to 16 in. and in thicknesses from $\frac{1}{16}$ to $2\frac{7}{8}$ in. To avoid confusion with other types of steel, each piece is identified along the full length. Each piece is also individually packaged in a protective envelope.

The L. S. Starrett Co., Athol, Mass. **T-9-41**

Magnetic Conveyors

Magnabelt magnetic conveyor, designed to handle ferrous parts through steep inclines, is infinitely adjustable from 60 to 90 deg. It has a magnetic top pulley, and a gooseneck extension to deposit parts into containers and permit removal of containers from front or either side.

Wheels in the base do not contact the floor during operation, but when the conveyor is tilted forward it can be rolled easily to another location. The belt is 6-in. wide neoprene and runs at 85 fpm. Substitution of a magnetic pulley for a slide type transition section at

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the gooseneck reduces power requirements and provides a positive transfer of parts to the horizontal belt. Standard portable models are available from 4 to 10 ft high in one-foot increments.

M-H Standard Corp., 515 Communipaw Ave., Jersey City 4, N. J. **T-9-42**

USE READER SERVICE CARD ON PAGE 185 TO REQUEST ADDITIONAL TOOLS OF TODAY INFORMATION

Expansion Chucking Reamers

Carbide tipped shell type expansion chucking reamers, with either straight or taper shanks, are available for mass production of parts having close-tolerance holes. Preloading of the shell on its holder gives strength comparable to

that of solid reamers, while allowing expansion to compensate for wear. When shells have been fully expanded, they can be easily replaced.

The grooved rear pilot of the expansion chucking reamer is ground slightly under the cutting diameter, making it possible to use this reamer either with or without guide bushings.

National Twist Drill & Tool Co., Rochester, Mich. **T-9-43**

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LOTS OF HOLES . . . FAST?

Standard Adjustable 3-spindle head, all spindles adjustable.

For two, three or four spindle drilling you can do it better, faster, at lower cost with U. S. Standard Adjustable Heads. *At the TOP in productive performance—at the BOTTOM in overall cost.*

Designed and built with more reserve stamina than you'll ever need . . . antifriction bearings . . . high alloy steel spindles and shafts . . . heat treated and shaved gears . . . more than ample spindle bearing . . . parts run in light lubricant (oil-mist available for speeds around 4000 rpm).

Write for catalog AD-57, showing the complete line of Standard and Universal Joint Adjustable U. S. Drill Heads.

Five styles of Standard Adjustable Heads include:

Two-spindle, 1 adjustable—9 sizes up to 5.5" max. center distance, ¼" to 1" drills.

Three-spindle, 2 adjustable—12 sizes, up to 6.9" max center distance, ¼" to 1⅜" drills.

Two-spindle, both adjustable—12 sizes, up to 12.0" center distance, ¼" to 1⅜" drills.

Three-spindle, all adjustable—12 sizes, up to 13.4" bolt circle, ¼" to 1⅜" drills.

Four-spindle, all adjustable—12 sizes, up to 15.2" bolt circle, ¼" to 1⅜" drills.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

UNITED STATES DRILL HEAD CO.

BURNS STREET • CINCINNATI 4, OHIO

Field Notes

First step in the evolution of the Hobart Brothers Technical School has been completed with move into new quarters in Westbrook, Ohio. The school which will be a nonprofit school devoted entirely to teaching, research and development in the welding field, covers 80,000 sq ft of floor space and provides 120 welding stations for training students in use of all types of arc and gas welding equipment. It also has classrooms, demonstration areas and auditorium, technical library, laboratories, research and testing facilities and an x-ray and radioisotope room.

At present, only welding operator training courses will be offered to students; with completion of more of the interior facilities and necessary teaching arrangements, a variety of technical subjects and courses will be offered. These are expected by the first of the year.

expansions

First major phase of Lukens Steel Co.'s $33-million expansion program has been completed. This phase brings into operation massive soaking pits which now have begun heating ingots weighing up to 75 tons each. Other major facilities to be completed by the spring of 1959 include new electric furnace which will raise Lukens' annual ingot capacity by some 25 percent (to 930,000 tons) and a 140-inch rolling mill which will raise the company's rolling capacity by about 40 percent. A total of nine pits, each capable of holding up to 200 tons of ingots, make up the new soaking pit battery at Lukens.

V V V

An expanded assembly warehouse to provide fast service in die sets, diemakers' accessories and toolroom supplies was opened in St. Louis at 3131-3137 Olive St. by Producto Machine Co. in conjunction with Tools and Supplies, Inc. of St. Louis. It will service eastern Missouri and southern and central Illinois.

V V V

A 10,000 square foot extension is being made to Zagar, Inc.'s building at 24000 Lakeland Blvd. in Cleveland. This expansion provides a 50 percent increase in office area and allows a closer integration of sales and engineering departments.

West Coast operations of Houghton Laboratories, Inc. have been expanded to improve service and deliveries in the area. A separate division, to be known as Hysol of California, is being formed and will have separate manufacturing, warehousing and laboratory facilities. Address of the new building is 1706 N. Potrero, El Monte, Calif.

V V V

Hays Mfg. Co. has completed occupation of the recently acquired addition to its plant. The new quarters comprise 115,000 sq ft of factory and office space.

new divisions

Formation of a new barrel finishing and wet blasting division has been announced by Wheelabrator Corp. By acquiring assets of Crandall Engineering and Manufacturing, Inc., the company adds a complete line of barrel finishing machines. Manufacturing and sales headquarters will be in Vicksburg, Mich., location of the acquired firm. Complete experimental and demonstration laboratories also are being maintained there.

V V V

American Silver Co. has set up a special division for precision toll-rolling. As a special service, the company will accept orders for toll-rolling niobium in experimental lots as well as in production quantities to permit necessary laboratory work in pioneering industries.

agreements

Ampco Metal, Inc. has licensed Canadian Bronze Co., Ltd. to pour Ampco Metal and distribute the firm's raw material products. Canadian Bronze, in Montreal, has five divisions through Canada. They include Montreal Bronze, Ltd. in Montreal, Northwestern Brass, Ltd. in Calgary, Northwestern Brass, Ltd. in Winnipeg, St. Thomas Bronze Co., Ltd. in St. Thomas, Ont., and Winnipeg Brass, Ltd. in Winnipeg.

V V V

A technical cooperation agreement has been concluded between Lobeck Casting Processes Inc. and Wieland-Werke of Ulm/Donau, West German manufacturer of nonferrous metal products. Under terms of the agreement, Lobeck can offer advanced designs of continuous casting equipment growing from 25 years of metallurgical engineering experience obtained by its German associates.

V V V

An agreement has been made between The Martin Co. and the Metal Products Div. of Koppers Co., Inc. under which Koppers may use certain designs and engineering data on noise suppression equipment developed by Martin.

trade associations

A two-day executive seminar will be conducted by National Screw Machine Products Association this fall in an effort to help improve management efficiency through problem interchange and analysis. The program, which will be held for a limited number of executives who direct companies of the same approximate size, will be concerned with five areas of management control: finance, production, sales, management-employe relations and management philosophy. Sessions will be divided into four groups with participation in each group determined by firm sales volume and number of employees.

V V V

Sponsored jointly by the National Machine Tool Builders' Association and the American Machine Tool Distributors' Association, a recent Machine Tool Sales Conference at Purdue University taught experienced sales engineers new tricks and showed aspiring salesmen how to give customers what they want. This conference has been held annually, alternating between Purdue and Cornell, for many years. It is reputed to be the only high-caliber course of its kind with a textbook written expressly for the course. Faculty, made up of leaders from universities and industry, included Charles Woodley, executive vice-president, Caterpillar Tractor Co., and Myron S. Curtis, Vice-president-engineering for Warner and Swasey Co.

V V V

The fourth annual Informative Labeling Contest was announced by The Society of the Plastics Industry, Inc. It is open to all companies and individuals manufacturing plastics products available to the public. The contest is an effort to encourage makers and suppliers of consumer plastics products to label them completely and accurately. Entry blanks for the competition, which closes October 26, may be obtained

from SPI headquarters, 250 Park Ave., New York 17, N. Y. A grand award and individual awards for nine major consumer product categories will be presented at the institute's national exposition and conference in Chicago in November.

v v v

National Screw Machine Products Association has prepared and published a 104-page manual which is calculated to serve as an estimating handbook for both independent producers and company-operated screw machine departments. The book, which took two years to prepare, covers such topics as basic quoting procedures and qualifications; materials; estimating production on various equipment; setup, operating, administrative and other costs; specific examples of estimating, and estimating forms and aids.

v v v

The Tool & Die Institute is publishing a Membership and Classified Services Directory. The book will include a graphic display of the services, by categories, of all its members.

research

A $750,000 applied research and development laboratory of the Foundry Dept. of General Electric Co. has been placed in full scale operation. The installation is for development of advanced methods of foundry technology and will provide the vital link between pure research from which new materials and processes are developed, and actual foundry use of such materials and methods as castings and improved production techniques.

The facilities are utilizing a nine-foot diameter vacuum degassing chamber to improve methods of eliminating gaseous impurities in molten cast metals. Other projects include development of improved methods of vacuum melting and processing of cast alloys to reduce impurities and improve cast properties; improved precision casting methods; and methods for reducing quantity of metal needed for risers in castings.

v v v

The United States Atomic Energy Commission has contracted with Stanford Research Institute to maintain a classified documents depository to serve the Western states. The depository includes an initial collection of 7,000 reports dealing with aspects of nuclear energy research. The new facility will serve scientists and engineers from firms holding AEC access permits. Arrangements for use of the SRI depository are made through the San Francisco Operations office of the commission at 518 Seventeenth St., Oakland, Calif.

v v v

Hanson-VanWinkle-Munning Co. has more than doubled its investment in research and development. The company also has expanded the electrochemical laboratory and the building and staffing of electrical and mechanical laboratories, to broaden its activities in electroplating and other metal finishing processes.

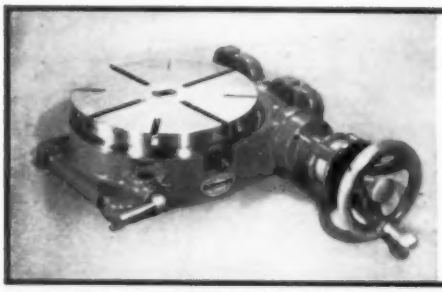
new facilities

Vidmar, Inc. has dedicated a new $400,000 plant at Williamsport, Pa. The facilities currently occupy 44,000 sq ft on an 11 acre site, and is designed to allow for expansion up to 100,00 sq ft when needed. Using a straight-line production method, raw materials are received at one end and completed products are shipped out of the other end. Cost of plant and equipment exceeded $650,000.

v v v

A warehouse-service center to serve Detroit area industry has been established by Eutectic Welding Alloys Co. of Michigan, Inc. at 416 W. Eight Mile Rd. The new facility will provide weldors and welding users in the area with resources of international welding research and development laboratories of Eutectic Welding Alloys Corp.

For angular spacing jobs so precise you could never handle them before



A Rotary Table accurate to ± 3 sec. in 360° (USING CHART)

No. 2 Moore 11-Inch Rotary Table, *developed by the builder of the Jig Borer and Jig Grinder.*

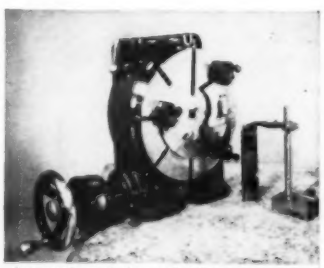
THE FOLLOWING ACCURACY BUILT FOR SHOP USE:
All points in 90° increments, from zero, ± 1½ sec.
All points in 18° increments, from zero, ± 2 sec.
All points in 2° increments, from zero, ± 4 sec.
Worm accuracy, ± 1 sec.
Repetition of settings, ± 1 sec.
4 sec. = .0001" on 10" dia.

How many jobs have slipped by you because the angular spacing requirements were just too much for your equipment?

With Moore's new 11-Inch Rotary Table, you can easily handle the most precise angular measurements. Having an overall performance accuracy of ± 6 seconds throughout the entire 360°, this table is already being used successfully by several leading companies on government-sponsored precision jobs never before accomplished.

This extreme accuracy is achieved by a non-disengagable, thread-ground worm, combined with accurately spaced teeth of its mating gear. An ultra-sensitive method of angular measurement—interferometric inspection and calibration—used industrially for the first time, assures tooth spacing accuracy within less than ± 4 seconds.

You can use this rotary table for countless precision spacing applications on jig borers and jig grinders. Examples: Spacing holes in a circle on either machine; set at right angle for additional machining and inspection jobs; with its companion unit, the new No. 2 Sine Plate, to produce compound angle settings. Write today for Bulletin RT2.



Accurate in vertical as well as horizontal position. Additional vernier permits natural reading even in vertical position.

Accuracy assured by interferometric inspection and calibration. This is the first time industry has used light-wave measuring methods for precise division of the circle.

MOORE SPECIAL TOOL COMPANY, INC.
732 Union Avenue, Bridgeport 7, Connecticut

ADD MOORE TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-198

The Narda Ultrasonics Corp. has acquired quarters at 625 Main St. in Westbury, N. Y. which provides 16,500 sq ft of additional production space. Sales, administration and other management functions of the company remain at the company's Herricks Rd. address.

V V V

Titeflex, Inc. opened a new plant in Monica, Calif. to provide immediate delivery and improved technical service to the West Coast aircraft and industrial customers. The new facility is a fully integrated manufacturing division with complete metal processing assembly and testing equipment.

new activities

An Ohio subsidiary, Unistrut Steel Products Co., has been established at 2167 Florence Ave. in Cincinnati by Unistrut Products Co. to serve an area formerly served by an independently owned distributorship.

V V V

Formation of a Chemical Process Div., was announced by Narda Ultrasonics Corp. which also revealed appointment of Dr. Bernard Schmidt as manager of the new division.

V V V

Whitnon Mfg. Co. has opened a new plant specializing in repair and reconditioning of all types of industrial and antifriction spindles. The plant is located at 20466 Wyoming Ave. in Detroit.

V V V

Pennsalt Chemicals Corp. is moving its sales department and research and development activities of the Corrosion Engineering Dept. to the Natrona, Pa. plant thus centralizing all manufacturing, sales and development activities.

V V V

All activities of the Automatic Warehousing Branch of Pesco Products Div., Borg-Warner Corp. now are housed in new, separate facilities. The move provides the branch with complete administrative and engineering offices, production facilities, stock storage and shipping area.

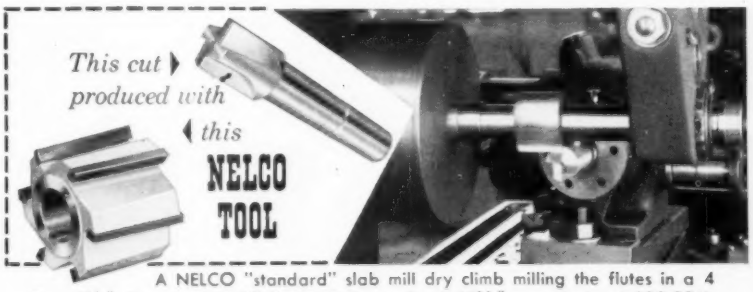
name changes

Name of the Controls Section of Bendix Aviation Corp. now has been changed to Industrial Controls Section of the corporation. The new name is considered more descriptive of the numerical controls now being manufactured and sold by the company.

HOW MAKE
NELCO TOOLS NELCO TOOLS

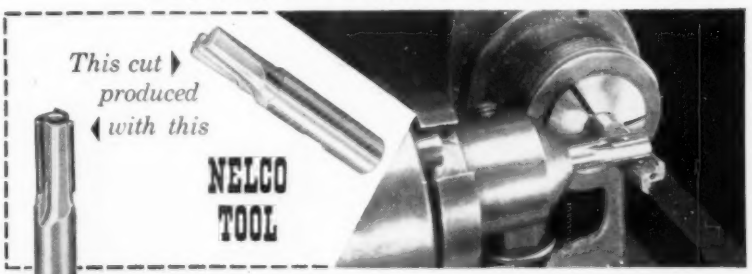
Every machining operation on over 700 different NELCO TOOLS is performed more efficiently with a NELCO TOOL!

WHY?...because the versatility, machining speed, superior surface finish and dependability of NELCO TOOLS produce finer tools, more economically.



A NELCO "standard" slab mill dry climb milling the flutes in a 4 flute, 1½" diameter NELCO End Mill. Power feed, 10½" per minute at 600 RPM.

A NELCO "standard" 3" side mill dry conventional milling the flutes in a 2 flute ½" diameter NELCO End Mill. Hand feed at 640 RPM.



A NELCO "standard" 3 flute end mill dry conventional milling the carbide tip seats in a 2 flute ½" diameter NELCO End Mill. Hand feed at 2100 RPM.

These are but three of the hundreds of milling, turning, boring, reaming operations involved in producing over 700 "standard" NELCO TOOLS.

SEND TODAY for the new NELCO Catalog showing over 700 different "standard" carbide and carbide tipped tools. Write:— *Cutting Tool Division, Brown & Sharpe Mfg. Co., Manchester, Conn.*

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CUTTING TOOL DIVISION

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Detroit sales offices of Master Electric Co. Div., Reeves Pulley Co. Div. and Reliance Electric and Engineering Co. have been moved to 2734 W. Eleven Mile Rd., in Berkley, Mich.

V V V

New York Air Brake Co. has changed the name of its manufacturing division in Kalamazoo, Mich. to the Hydreco Div. The change was made to associate the division more closely with the trade name carried by the industrial hydraulic equipment built at that plant.

corporate changes

Stockholders of The Waterbury Farrel Foundry & Machine Co. approved sale of assets, property and business of the company to Textron Inc. for $7,135,500 net cash and assumption of Waterbury Farrel's debts, obligations, contracts and liabilities. The acquired firm now is operating as the Waterbury Farrel Foundry & Machine Co. Div. of Textron Inc.

V V V

Thompson Products, Inc. and its affiliate, The Ramo-Wooldridge Corp. have signed an agreement providing for merger of the two companies. Plans provide for the resulting company to be named Thompson Ramo Woolridge Corp. Consummation of the agreement to merge the companies is subject to conditions which include approval of the transaction by stockholders.

V V V

The Motch & Merryweather Co. has acquired the Wink Cutter Div. from F. J. Fink & Co. At the beginning of this year, Motch & Merryweather consolidated its Cleveland manufacturing operations and sales headquarters in its expanded factory and office at the Euclid Plant where Wink equipment will be produced. Mr. Frank J. Fink is joining Motch & Merryweather as manager of the Wink Cutter Div.

V V V

Lindberg Steel Treating Co. has acquired processing facilities of the flame hardening department of the Metal Improvement Co. in Los Angeles. These facilities have been integrated into selective heating division of Lindberg's Los Angeles Branch and will provide additional productive capacity for selective heating services by the oxyacetylene method.

V V V

The Claud S. Gordon Co., a firm specializing in manufacturing and distributing supplies in heat treat and heat measurement fields, has been acquired by Cleveland Pneumatic Industries, Inc. Present management and personnel of

the Gordon Co. will be retained, and the company will operate as a subsidiary of Cleveland Pneumatic.

V V V

Houdaille Industries, Inc. has completed negotiations for the cash purchase of all capital stock of Provincial Engineering Ltd. of Niagara Falls, Ontario. According to statement from the acquired firm, an investment "in excess of $2-million" is involved. Provincial Engineering now becomes a wholly owned subsidiary of Houdaille.

V V V

H & B American Machine Co., Inc. has acquired control of General Trading Co. and its 42 wholesale branches. Arnold Main, president of General Trading, continues as chief executive officer of the company and all operations, including personnel and staff, will continue under his supervision.

V V V

Pressure Blast Mfg. Co., Inc. of Manchester, Conn. has acquired all assets and manufacturing rights of the former Cro-Plate Co. The entire line of pressure blast wet blasting equipment and abrasives is being continued. Manufacturing and sales offices have been relocated at Manchester.

new offices

Latrobe Steel Co. has opened a branch office in St. Louis to serve the Missouri-Kansas area and nearby states. Also under construction for Latrobe Steel is a $250,000 West Coast warehouse and office at 2919 Tanager Ave. in Los Angeles.

V V V

Opening of two district offices in Memphis, Tenn., and Albany, N.Y., is announced by The Lincoln Electric Co.

V V V

Establishment of a Western sales office with headquarters in Los Angeles has been announced by The Budd Co. This coordinates west coast sales activities for two of the company's subsidiaries, Continental-Diamond Fibre Corp. and Tatnall Measuring Systems Co., and for its Defense and Nuclear Systems Div.

V V V

Quaker Rubber and Leschen Wire Rope, both divisions of H. K. Porter Co., Inc., have opened joint sales and service branch offices in New Kensington, Pa. The facility, which provides added office space and combined warehouse accommodations for both divisions, will serve West Virginia, eastern Ohio and western Pennsylvania.

Helping Leading Manufacturers Give You Better Machine Tools!

We at True-Trace are proud to be a part of and contribute to the above manufacturers' reputation in producing accurate, dependable tracer and numerically controlled machines–equipment that can be counted upon to produce the precision, complex parts so vital in today's metalworking industry. These leaders know they can depend upon True-Trace machine tool controls to do the best job. After complete investigation of various control systems available, they, with others, have selected True-Trace as original equipment.

When you think of new machinery for your plant expansion or modernization...look to these leaders for quality equipment you can count on. Or–if you're considering the conversion of existing manual machines to tracer or numerical control...do as the leading machine tool builders have done–specify True-Trace!

"More True-Trace Machine Tool controls are used as original equipment by more machine tool builders than all other control systems combined."

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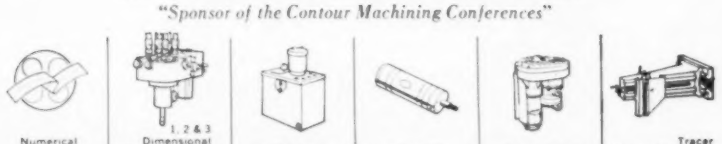

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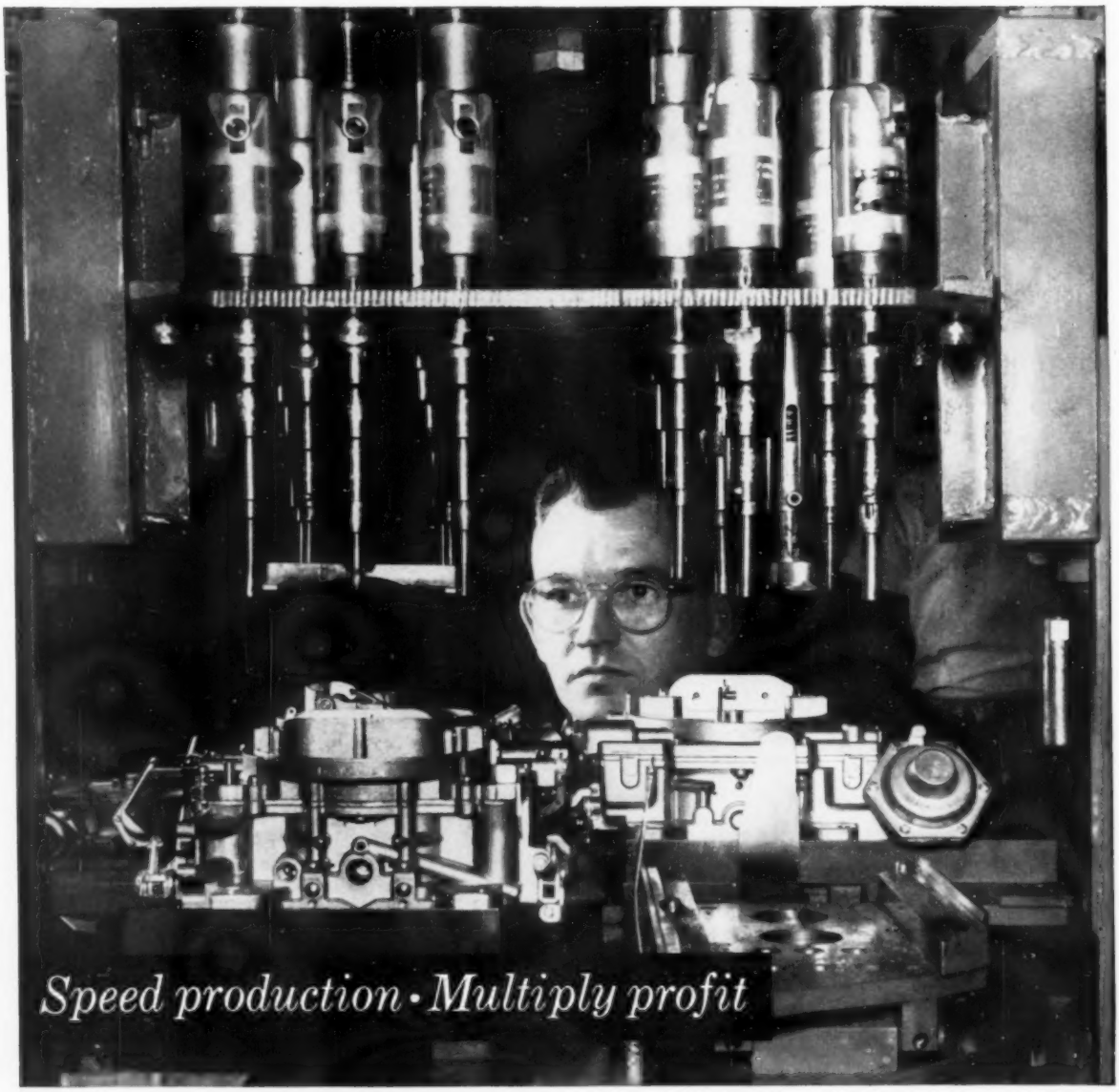

Team of ten spindles prepares to drive home equal number of screws in this assembly of carburetors at Carter division of ACF Industries Inc., St. Louis, Mo. All fasteners are secured simultaneously at identical torque. Initial cost of Thor multiples is low—so is cost of maintenance.

THOR MULTIPLE NUT SETTERS AND SCREWDRIVERS

Thor multiples are custom engineered to your order. Any assembly involving 2 to 22 fasteners can be completed faster, more efficiently—with great labor savings. Product or pattern is no problem. Write today for Thor's complete automation manual on multiple fastener settings. Thor Power Tool Company, Aurora, Illinois.

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THOR POWER TOOL COMPANY, AURORA, ILLINOIS

Men at Work

Several appointments recently were made at Oakite Products, Inc. J. JUSTIN BASCH, formerly vice-president for research and product development, has been named to the new position of marketing vice-president and will be responsible for sales, engineering, advertising and marketing research as well. CLARENCE BREMER, who now is technical director, has responsibility for all research, product development and technical service laboratory work. Dr. Bremer previously was director of research. WILLIAM A. BALTZELL, who has been assistant sales manager, became industrial sales manager responsible for work of the company's 17 divisions and all technical service representatives.

FRANK J. FIELDS, formerly works manager of The Fosdick Machine Tool Co., is now president of the firm. Mr. Fields joined Fosdick in 1957, after serving as executive vice-president and general manager of the Sidney Machine Tool Co. Unfortunately, Mr. Field was erroneously reported as being associated with Hufford Machine Tool Co. in the July issue of THE TOOL ENGINEER.

Brown & Sharpe Mfg. Co. has made WILLIAM P. SHEFFIELD assistant to the general manager of its Cutting Tool Div. He previously held the post of superintendent of the Cutting Tool Group at the company's Greystone plant. A position now filled by FRANK E. MONTIE.

WILFRED E. WALTON was named director of engineering for DeWalt Div. of American Machine and Foundry Co. Mr. Walton, who formerly was associated with the Government Products Group of AMF, now will coordinate all engineering operations at DeWalt.

Four executive promotions recently were announced at The Sheffield Corp. JACK T. WELCH was appointed vice-president in charge of field sales and WILLIAM I. WILT was named vice-president, gage and instruments division. VICTOR J. BOLL was promoted to the post of assistant vice-president of the contract manufacturing division while THOMAS W. CLARK became assistant vice-president of the service facilities division. Messrs. Welch and Boll are members of ASTE's Dayton chapter, and Mr. Clark belongs to ASTE's Detroit chapter.

New officers for the American Society for Testing Materials are KENNETH B. WOODS, president and A. ALLAN BATES, vice-president. FRAN L. LAQUE is continuing as senior vice-president. Mr. Woods is head of School of Civil Engineering and director of Joint Highway Research Project, Purdue University. Mr. Bates is vice-president of research and development at the Portland Cement Association; and Mr. LaQue is vice-president and manager, development and research at The International Nickel Co., Inc.

HAROLD G. INGERSOLL, JR., who has been executive vice-president and general manager of Ingersoll Steel Div. of Borg-Warner Corp., was recently president and general manager of the division. He succeeds L. G. PORTER who became chairman of the division's supervisory board. Mr. Porter is executive vice-president of Borg-Warner, the parent corporation.

To fill the post of division executive vice-president vacated by Mr. Ingersoll, the company named former division vice-president HOWARD E. MORISON.

At Sealol Corp. ALAN J. WOODFIELD has become new executive vice-president. He formerly was executive vice-president and general manager of LaFavorite Rubber Co.

Other changes at Sealol included appointment of JUSTUS B. STEVENS as vice-president in charge of the newly formed Seals and Accessories Group, and of FRANK BOTTOMLY as vice-president in charge of the new Tools and Equipment Group.

At the annual meeting of National Fluid Power Assn., JOHN A. MARSH, was elected to the office of national president. To serve with him, the association elected L. L. CHARLSON and FRANK FLICK as first and second vice-president respectively. Mr. Marsh is vice-president in charge of sales of the Air and Hydraulics Div. of Rivett Lathe & Grinder, Inc. Mr. Charlson is president of Char-Lynn Co., and Mr. Flick is president of Flick-Reedy Corp.

Changes in the engineering department at C. A. Norgren Co. involved ANDREW ZMUDA who was made chief engineer; Morley V. Freidell, now supervisor of the newly created research and development section; Ralph C. Baker, now engineering laboratory supervisor to head the laboratory work; and Kirk Carlsten, who became product design and drafting supervisor.

Election of officers at the annual meeting of the Alloy Casting Institute made PAUL L. MCCULLOCH, JR. president and J. B. DEAR vice-president for the coming year. Mr. McCulloch is president of Electro-Alloys Div. of American Brake Shoe Co. and Mr. Dear is general sales manager of The Duraloy Co.

Thomas J. Ault, former president of several divisions of Borg-Warner, was elected president of Saco-Lowell Shops succeeding Malcolm D. Shaffner who is now chairman of the board.

J. B. Sewell has been made president of The Garlock Packing Co. of Canada, Ltd. This year he also was named vice-president-marketing of the U. S. firm. He has been vice-president-sales.

Robert A. Warfel is now vice-president and works manager of Nelco Tool Co., Inc., a subsidiary of Cutting Tool Div. of Brown & Sharpe. He was superintendent of new product development.

Appointments of two new superintendents to head Buick Dynaflow transmission production have been announced. H. RICHARD O'HARA, JR. was made superintendent of Buick Factory 5 in charge of Dynaflow machining and heat treatment, and THOMAS A. LAWTON was named superintendent of Factory 10 in charge of Dynaflow machining and assembly. Both men had been general assistant superintendents of their respective plants. Mr. O'Hara is a member of ASTE's Saginaw Valley chapter.

Werner Pflug is now vice-president of National Carbide Die Co. He has been superintendent of Sirian Wire and Contact Co.

A. I. Nussbaum is new vice-president of Loma Machine Manufacturing Co., Inc. and its affiliate Lobeck Casting Processes Inc. He formerly was manager of Loma's Rolling Mill Div.

At Minneapolis-Honeywell's Boston Div., W. A. ROTE has assumed responsibilities of director of engineering, heading research and development, preproduction, product and special engineering activities. He formerly was chief engineer.

Newly elected president of the Drop Forging Assn. is GORDON R. WALKER, head of Walker Forge, Inc. Elected to serve with Mr. Walker as vice-president is LOUIS M. FEHRENBACH, president and general manager of the Indianapolis Drop Forging Co., Inc.

Clevite Corp. recently elected A. L. W. WILLIAMS vice-president of the firm. Prior to this he was in charge of the corporation's Research Center. Operations at the center now will be directed by HANS JAFFE, who became director of electronics research, and ARTHUR D. SCHWOPE, who is now director of mechanical research. Mr. Williams was president of Brush Development Co. when it merged with Clevite in 1952.

New executive vice-president and general manager of all Allied Products Corp.'s activities is ROBERT A. NIEMI. Prior to this appointment, he was general manager of Plymouth Div. of Burroughs Corp.

JAMES L. ANAST, formerly technical director of the Airways Modernization Board, has joined Lear, Inc. as assistant to the president—for technical planning.

The National Society of Professional Engineers elected CLARK A. DUNN president for the coming year. Dr. Dunn is a professor of civil engineering and executive director of the office of engineering research at Oklahoma State University. Vice-Presidents of NSPE include HAROLD A. MOSHER, JOHN B. MCGAUGHY, L. E. EASLEY, W. L. HINDERMANN, L. R. DURKEE, NOAH E. HULL and RUSSELL B. ALLEN.

New manager of the Cleveland Works of National Malleable and Steel Castings Co. is WILSON P. BURNS who replaces STEWART TAME who retired. Mr. Burns has been superintendent of National Malleable's Sharon Works since 1948.

Announcement from Philadelphia Gear Corp. revealed election of S. L. CRAWSHAW as a vice-president of the firm where he will direct the new high precision gear grinding activities.

PAUL N. CLARK was named director of engineering and GLENN J. HARTUNG plant engineer at Robbins Floor Products, Inc. Mr. Clark was formerly consulting engineer and plant engineer. Mr. Hartung, who is a member of ASTE's Birmingham chapter, has been engaged in engineering and design work on exclusive Robbins products.

5 Basic Reasons why
MARVEL HACK SAWS
CUT-OFF MORE ACCURATELY...

The consistently accurate performance of MARVEL Heavy Duty Hack Saws is no accident. MARVEL engineers knew, many years ago, that to produce and maintain accurate cutting-off, a hack saw must be designed and built like a fine machine tool.

Some of the basic design principles built into the modern MARVEL Hack Sawing System that makes it the most accurate cutting-off method you can use are:

1. V-Way Design...Greater Rigidity

Upright and Saddle are precision machined and fitted to form a rigid, integral unit capable of withstanding any cutting load with no deflection or side movement.

2. Anti-Friction Bearing Construction

Anti-friction ball or roller bearings are used at all load carrying points. Even the strongly forced saw frame reciprocates on heavy duty, fully enclosed preloaded ball bearings which provide permanent, frictionless rigidity and true-running, straight line cutting strokes.

3. Minimum Blade Frame Reach

Close-coupled design and crank lever action of MARVEL Saws keeps the saw frame and blade reach very short in relation to the vertical V-ways on which the unit is mounted. This insures optimum rigidity, even under the most severe operating conditions.

4. Positive Relief Blade Lift

On the return stroke, positive relief lift raises the blade to provide proper and "cushioned" lead-in on the next cutting stroke. This prolongs blade sharpness, life and accuracy.

5. Rigid Cutting Tool

Cutting-off accuracy requires a rigidly held, relatively short cutting tool. MARVEL Unbreakable High-Speed-Edge Hack Saw Blades, which combine a narrow high speed steel cutting edge permanently welded to a tough alloy steel body, can be tensioned from 200% to 300% more taut than ordinary blades. This provides a most rigid cutting edge.

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technical shorts

Ceramics Fused With Alloys For Heat Resistance

DEVELOPMENT of new materials that will withstand heats up to 5000 F, is anticipated as a result of successful fusing of specially developed ceramic coatings with advanced metal alloys. According to The Bettinger Corp., where such work is being done, present day coatings can withstand heats in the neighborhood of 3000 F for short periods. Nathaniel Cannistraro, Bettinger president points out that, while major applications for the coatings are now in earth satellites, aircraft, rockets and heat-producing engines, wider use of ceramics to coat metals could result in substantial reduction of the $6-billion annual loss attributed to corrosion.

The ceramic coatings provide protection not only against high temperatures and corrosion, but also against shock, abrasion and fatigue. Tests have shown that some coated metal samples have a fatigue life ten times longer than uncoated samples.

A major advantage of the coatings, which are applied in films 0.001 to 0.002 in. thick, is the manner in which they add strength and other resistive qualities to low-grade metals and alloys, permitting these metals to give considerably better performance.

★ ★ ★

Film Correlates Man's Progress And Energy

MEASUREMENT's role in man's efforts to harness the sources of energy is dramatized in a color motion picture designed to interest young people in the world of science. The film, released by the National Bureau of Standards, is presented in the form of a lecture-demonstration. It traces historical development of means for utilizing energy sources, from muscles of prehistoric man, to the steam engine, to uranium fission and free radicals. Significance of physical measurement is illustrated by experiments which recreate important scientific discoveries which revealed new sources of energy.

Among the demonstrations are those illustrating transformation of mechanical, chemical, thermal, electrical and nuclear energies from one form into another.

The 33-minute 16 mm film is available for loan or for sale from the Office of Technical Information, National Bureau of Standards, Washington 25, D. C., or from the Bureau's Boulder Laboratories, Boulder, Colo.

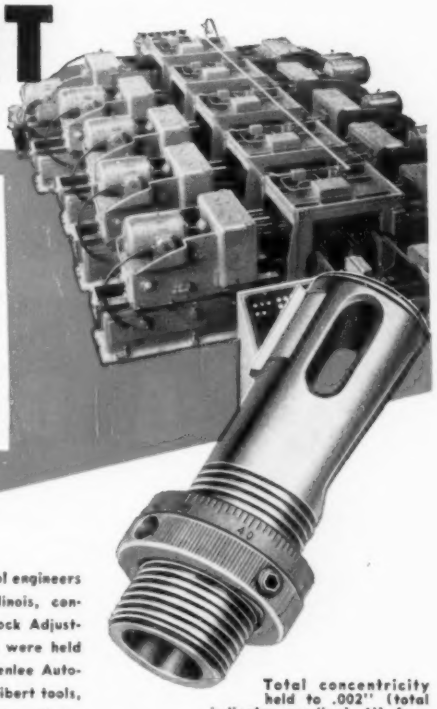
New Alloy Withstands Stress Corrosion

A PRIME metallurgical problem of stress corrosion cracking appears to be surmounted with development of a new Grade 8 alloy by Ampco Metal, Inc. The alloy, which differs only in a minor, but vital, respect from other bronzes, has been successfully patented in the United States, and additional patents are pending in six foreign countries.

Three years of testing, both in laboratories and field applications without failure for the perfected alloy is reported by J. F. Klement Co. director of

SEIBERT ADAPTERS

well within tolerance standards *say* GREENLEE ENGINEERS



● More than 5 years ago, tool engineers at Greenlee Bros. & Co., Rockford, Illinois, conducted extensive tests on Seibert Shur-Lock Adjustable Adapters to determine if tolerances were held within their standards. As a result, Greenlee Automatic Transfer Machines, equipped with Seibert tools, are to be found in operation today in many of the world's largest mass production plants. Quality, service and price are the three reasons hundreds of users, like Greenlee, are today specifying Seibert tools. There is an experienced Seibert representative in every key industrial area to work with you in solving your specific tool holding problems.

Total concentricity held to .002" (total indicator reading) 6" from end of Adapter. Manufactured to GMC, Ford, Chrysler, and ASA standards.

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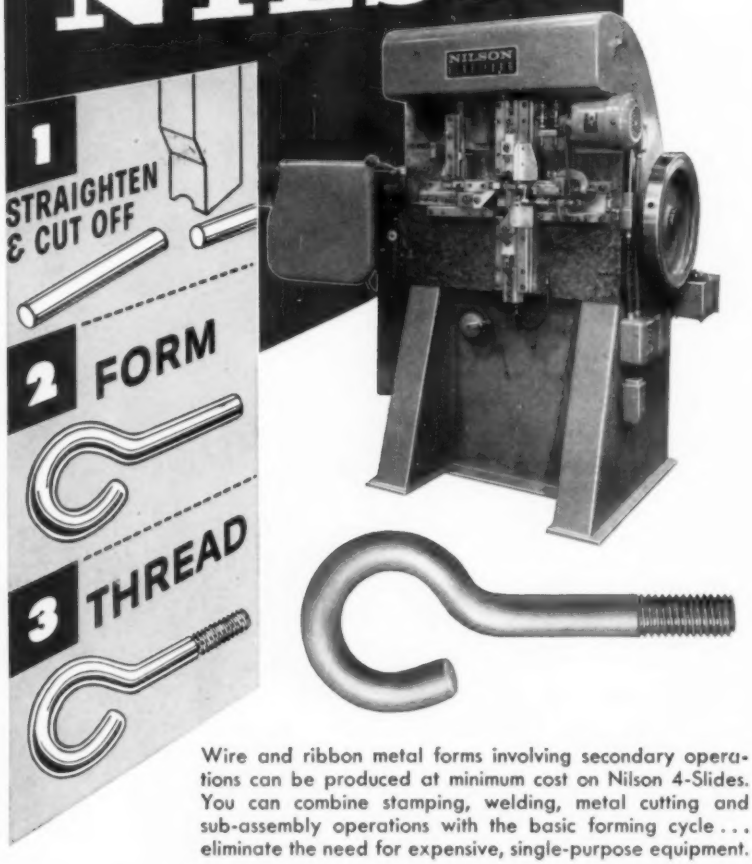

Wire and ribbon metal forms involving secondary operations can be produced at minimum cost on Nilson 4-Slides. You can combine stamping, welding, metal cutting and sub-assembly operations with the basic forming cycle . . . eliminate the need for expensive, single-purpose equipment.

The Nilson "Vertiform" shown above, for example, has a die head mounted on the right-hand forming slide. Wire stock is straightened, cut off, formed and threaded—all automatically in one cycle!

In addition to the new "Vertiform," Nilson builds 17 models of horizontal 4-slides, including 5 ribbon metal machines with built-in press units. For a new approach to low-cost production of wire forms and small metal stampings, it will pay you to get in touch with Nilson.

Send today for the Nilson General Catalog on Automatic 4-Slide Equipment!

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AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT
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research. The material proved out on these counts: no stress corrosion failures; safe employment of maximum allowable design stress, and weldability superior to know copper-base alloys. The new material now is permitted for use in the construction of ASME approved pressure vessels and can be used up to 500 F. with an allowable working stress of 70,000 psi.

Heretofore it has been necessary to stress relieve all finished fabrications to guard against stress corrosion cracking. With the Grade 8 alloy this need is eliminated (although stress relief for other reasons may continue to be occasionally necessary). In addition, field changes, alterations or repairs can now be freely made without heat treatment.

J. D. Zaiser, president of Ampco, together with research and sales heads, believe the development will enable the firm to offer its products in a great number of fields where it has heretofore been impractical to do so. This applies particularly in the vapor phase of various corrosive media. He also predicts the discovery will provide impetus to use of aluminum bronze in competition with nickel-bearing and stainless steel alloys in many applications which have heretofore been confined to these alloys.

★ ★ ★

Bonding Processes Joins Aluminum And Stainless

A NEW technique called pressure bonding joins aluminum and stainless steel and appears to promise possibilities for use of aluminum in combination with such metals as carbon and alloy steels, copper, and other aluminum alloys. Display of successful use of the new method was an electric pan produced by Aluminum Co. of America and displayed by Toastmaster Div. of McGraw-Edison Co. For this work, Alcoa casts aluminum slugs which are then die forged, under exacting conditions, to a stainless steel body. The steel shell is the inside surface. The process makes it possible to obtain the heat-conducting superiority of aluminum and to readily apply a heating element to the stainless steel.

Many combinations of aluminum alloys have been joined with good results. A cast plate, containing a heating element, now can be pressure-bonded to the bottom of a preformed wrought alloy aluminum pan.

Also under development is the pressure-bonding of relatively low-strength aluminum bearing alloys to high-strength aluminum castings and forgings. A single aluminum part then provides high strength, while also presenting a surface having excellent bearing characteristics.

who's meeting and where

Sept. 12-13. Society of Plastics Engineers, Inc., Detroit Section. Regional technical conference on "Plastics in Automotive Application", St. Clair Inn, St. Clair, Mich. Direct inquiries to John D. Young, 16915 Bucklingham Rd., Birmingham, Mich., or Richard C. Oglesby, c/o Rohm & Haas, 20211 Greenfield Rd., Detroit 35, Mich.

Sept. 14-19. Instrument Society of America. Instrument-Automation conference and exhibit, Convention Hall, Philadelphia, Pa. Further information is available from society office, conference and exhibit manager, Fred J. Tabery, 3443 S. Hill St., Los Angeles, Calif.

Sept. 14-26. Pennsylvania State University. Fourth annual technical report writing seminar. Further information is available from Extension Conference Center, The Pennsylvania State University, University Park, Pa.

Sept. 15-17. American Society of Mechanical Engineers. Process industries conference, Statler Hotel, Buffalo, N. Y. For details, contact society headquarters, 29 W. 39th St., New York 18, N. Y.

Sept. 22-23. Steel Founders' Society of America. Fall meeting, The Homestead, Hot Springs, Va. Get more facts from society office, 606 Terminal Tower, Cleveland 13, Ohio.

Sept. 22-24. Standards Engineers Society. Seventh annual meeting, Benjamin Franklin Hotel, Philadelphia, Pa. Obtain details from society office, P.O. Box 281, Camden 1, N.J.

Sept. 23-26. Association of Iron and Steel Engineers. Iron and Steel Exposition, Cleveland. Complete data may be had from association office, 1010 Empire Bldg., Pittsburgh 22, Pa.

Sept. 25-27. Porcelain Enamel Institute. Annual meeting, The Greenbrier, White Sulphur Springs, W. Va. Contact institute office, Associations Bldg., 1145 Nineteenth St., N.W., Washington D. C. for more details.

Sept. 28-Oct. 1. American Society of Mechanical Engineers. Power conference, Statler Hotel, Boston, Mass. Get details from society office, 29 W. 39th St., New York 18, N.Y.

Sept. 28-Oct. 2. Electrochemical Society, Inc. Engineering meetings and symposia, Chateau Laurier, Ottawa, Canada. More details may be obtained from society headquarters, 1860 Broadway, New York 23, N.Y.

Sept. 28-Oct. 2. Pressed Metal Institute. Annual meeting. The Cloisters, Sea Island, Ga. For more information contact institute office, 3673 Lee Rd., Cleveland 20, Ohio.

Sept. 29-Oct. 3. American Society of Tool Engineers. Western Tool Show and Conference, Shrine Exposition Hall, Los Angeles, Calif. All details are available from Society headquarters, 10700 Puritan Ave., Detroit 38, Mich.

Oct. 13-15. American Institute of Electrical Engineers. 10th National Machine Tool Conference, Statler Hilton Hotel, Hartford, Conn. Advance registrations may be made with William P. Carpenter, chairman of registration committee, c/o Superior Electric Co., 83 Laurel St., Bristol, Conn.

Oct. 13-15. National Electronics Conference. 14th annual conference, Hotel Sherman, Chicago, Ill. For further information, write program committee chairman, L. W. Von Tersch Electrical Engineering Dept., Michigan State University, East Lansing, Mich.

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END MILLS
Eclipse exclusive design end mills offer many advantages never before obtainable . . .
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KEEN CUTTING EDGE . . . for finer finishes, longer life and greater production at increased rates of feed.
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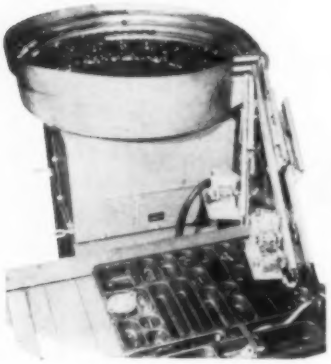
Complete Vibratory

PARTS FEEDERS



SYNTRON can supply complete Parts Feeders to your specifications — drive unit, oriented bowl and discharge track with escapement devices.

Send parts and specifications to our engineers for detailed information and recommendations.

or

work out your own orientation problems starting with *SYNTRON*

Vibrating Drive Units and/or Bowls

By supplying the basic equipment SYNTRON makes it easy for anyone with a small parts handling problem to automate their process equipment.

SYNTRON can supply drive unit and bowl as a single unit or drive unit and bowl can be purchased individually.

You engineer the orientation of feeder bowl and discharge track to meet your own specific needs.

MW 1058

Equipment of Proven Dependable Quality

Other SYNTRON Equipment

designed to increase production, cut production costs, improve products

Vibrators (bins, hoppers, chutes)	Rectifiers (Silicon and Selenium)
Vibratory Feeders	a-c to d-c Selenium Rectifier Units
Vibratory Screens	Electric Heating Panels
Shaker Conveyors	Electric Heating Elements
Vibratory Elevator Feeders	Sinuated Wires
Weigh Feeders	Shaft Seals
Packers and Jolters	Electric Hammers
Hopper Feeders	Concrete Vibrators
Lapping Machines	Paper Joggers

Our representatives will be glad to work with you in selecting the proper equipment for your operation.

Call your nearest Syntron representative

For more information write for complete catalog . . Free

SYNTRON COMPANY

340 Lexington Ave. Homer City, Pa.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-208

Oct. 14-16. American Society of Mechanical Engineers. Lubrication—ASLE conference, Statler Hotel, Los Angeles, Calif. Pertinent data may be had from society headquarters, 29 W. 39th St., New York 18, N.Y.

Oct. 16-17. Illinois Institute of Technology and Armour Research Foundation. National conference on industrial hydraulics, Hotel Sherman, Chicago, Ill. Address inquiries to Conference Coordinator, IIT, 3300 Federal St., Chicago 16, Ill.

Oct. 21. Society of Plastics Engineers, Inc., Upper Midwest section. Regional technical conference on epoxies, Curtis Hotel, Minneapolis, Minn. Chm. Russell B. Kirby, Jr., c/o Minnesota Mining & Mfg. Co., 900 Fauquier St., St. Paul, Minn. can supply full data.

October 23-25. Fluid Control Institute. Fall Meeting, Drake Hotel, Chicago, Ill. Write for complete data to R. McCormick, Public Relations Committee, Fluid Controls Institute, c/o Automatic Switch Co., Florham Park, N.J.

Oct. 23-25. National Society of Professional Engineers. Fall meeting, St. Francis Hotel, San Francisco, Calif. For details, contact society headquarters, 2029 K St., N.W., Washington 6, D.C.

Oct. 24. Society of Plastics Engineers, Inc., Golden Gate section. Regional technical conference on plastics and electronics. For more data contact Golden Gate President, Julius W. Palen, c/o Lenkurt Electric Co., San Carlos, Calif.

Oct. 27-31. American Society for Metals. National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland, Ohio. Complete facts may be had from society office, 7301 Euclid Ave., Cleveland 3, Ohio.

Oct. 28. Ultrasonic Manufacturers Association. Annual meeting, Hotel Cleveland, Cleveland, Ohio. Association office, 271 North Ave., New Rochelle, N.Y., can supply more information.

Oct. 29-30. Armour Research Foundation. Computer applications symposium, Morrison Hotel, Chicago, Ill. All facts are available from the Conference Secretary, Armour Research Foundation of Illinois Institute of Technology, 33 10 W. 35th St., Chicago 16, Ill.

Oct. 29-31. Metal Treating Institute. Annual meeting, Hotel Cleveland, Cleveland, Ohio. All information may be obtained from institute office, 271 North Ave., New Rochelle, N.Y.

Trade Literature

for free booklets and catalogs—use request card, page 185

Furnaces

Twenty-two page Bulletin 242 describes hardening, carbonitriding and carburizing furnaces of both batch and continuous types, extensively illustrated with photos and drawings of applications and installations and important design and construction features. Lindberg Engineering Co., 2444 W. Hubbard St., Chicago 12, Ill. **L-9-1**

Taps

Line of ALT collapsible taps described in illustrated Catalog G-94-1 includes information concerning design and operating features, specification tables and ordering information. Landis Machine Co., Waynesboro, Pa. **L-9-2**

Index Tables

Design characteristics of roller gear drive indexing mechanism in line of Intermittor index tables and rotary transfer machines explained in Catalog No. 302; gives load ratings and dimensions for more than 175 index tables and outlines other important data. Ferguson Machine Corp. of Indiana, 7818 Maplewood Industrial Court, St. Louis 17, Mo. **L-9-3**

Vacuum Pumps

Extensively illustrated with photos, drawings diagrams and charts, 68-page Bulletin 6-1 presents detailed technical data on construction, function and operation of high vacuum vapor pumps; includes tables of specifications for various makes and models of pumps as well as comprehensive discussions of pump supplies and accessories; also gives important information, clarified by many examples, to help users select proper pump for specific jobs. Consolidated Electrodynamics Corp., Rochester Div., 1775 Mt. Read Blvd., Rochester 3, N.Y. **L-9-4**

Drafting Machines

Profusely illustrated 12-page brochure emphasizes important features of various models in German made Kuhlmann line of precision drafting machines; also shows usefulness of different accessories for this equipment. Impex Inc., 3801 Kirby Dr., Houston, Texas. **L-9-5**

Hydraulic Cylinders

Six-page Bulletin No. 658 presents pertinent data on compact C4H Series 1⅛-in. bore hydraulic cylinder; drawings show details of various mounting styles. The Sheffer Corp., 326 W. Wyoming Ave., Cincinnati 15, Ohio. **L-9-6**

Spacers

Main features and advantages of Micrometric adjustable arbor spacers for quick and economical set-up discussed in well illustrated 4-page folder. The O K Tool Co., Inc., 61 Elm St., Milford, N. H. **L-9-7**

AND NOW! A HYDRAULIC
"Challenger"...
BOYAR-SCHULTZ
6 x 18 SURFACE GRINDER
ONLY $1795.00
for a 6-18 Hydraulic Surface Grinder
Since the introduction of the amazingly low priced Hand Feed Boyar-Schultz Challenger Surface Grinder just a few months ago, we have been delighted with its acceptance.
So many users have requested a 6-18 machine in a low price range equipped with hydraulic longitudinal feed, that we proudly present another in an ever growing line of economy machines featuring high quality performance.
Don't buy, till you see and try this great machine.
See your nearest dealer or write
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FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-209

Cutting Tools

Spiral-bound 88-page Catalog VR-58 covers complete line of cutting tools; tab indexed for easy use, contains explanation of grade recommendations for machining all materials used in metalworking; chart shows how to select proper grade of carbide for specific applications plus recommended cutting speeds. Vascoloy-Ramet Corp., Waukegan, Ill. **L-9-8**

Grinding Wheels

Straight, sided wheels, segments, cylinders, cups and nut inserted wheels for surface grinding operations are described in 8-page Booklet PG-349, "Cincinnati Surface Grinding Wheels;" includes table of suggested gradings for surface grinding; well illustrated to show products in use. Cincinnati Milling Products Div., Cincinnati 9, Ohio. **L-9-9**

accent on Accuracy!

Whitnon Boring Spindles

The efficiency of a Sextant depends on accuracy of manufacture.

The accuracy of these spindles accents Whitnon's ability to provide precision spindle performance . . . for longer tool life and increased production.

Whitnon Spindles are engineered for rigidity and machined to super-close tolerances . . . incorporating extra-capacity bearings and large alloy-hardened shafts to eliminate radial and axial deflection. Spring pre-loaded . . . grease lubricated . . . sealed for life . . . and dynamically balanced after assembly.

Designed and built by spindle specialists in one of the best equipped plants in the industry.

WRITE FOR LITERATURE TODAY.

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ROUTE 6 AND NEW BRITAIN AVE., FARMINGTON, CONNECTICUT

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Slitting

Basic information on slitters and allied equipment presented in 76-page illustrated handbook, "Multiple Rotary Slitting Lines;" covers design, selection and operation of slitters and slitting lines; includes time studies, analysis of operating cycles, methods of coil handling, scrap disposal and operating data; catalog section outlines specifications, capacity tables and other data on company's slitting equipment and accessories. The Yoder Co., 5500 Walworth Ave., Cleveland 2, Ohio. **L-9-10**

Tooling Compounds

Five practical technical data bulletins provide working information and describe materials, products and equipment used in plastic tooling methods; Bulletins ATM1, FCS, T2, T26A and T29 each discuss specific products. Houghton Laboratories, Inc., 222 Houghton Ave., Olean, N.Y. **L-9-11**

Material Handling

Extensively illustrated by drawings and photos, 44-page Catalog CDA describes Cable-Way overhead conveyor, emphasizing important features; Includes complete installation information and photos. Conveyor Div., The American MonoRail Co., Fourth & Franklin Sts., Tipp City, Ohio. **L-9-12**

Slot Dies

Illustrated 8-page Bulletin 258, "Facts About Standardization of Oberg Carbide Slot Dies," explains manufacturing concept behind standardization of this tooling, which allows most carbide slot dies to be ordered from stock, and discusses resultant economies and other advantages; includes pricing sheet. Oberg Mfg. Co., Inc., Silverville Rd., Tarentum, Pa. **L-9-13**

Holding Devices

Extensively illustrated 25-page Catalog No. 158 presents "precision holding devices for rapid fire production," emphasizing advantages through speed, and economy resulting from their application; discusses uses, operation and maintenance of equipment. Heinrich Tools Inc., Racine, Wis. **L-9-14**

Heat Treat Equipment

Illustrated 200-page Catalog 158 describes complete line of electric ovens, furnaces, baths, environmental cabinets, related temperature control equipment and accessories for laboratory, pilot plant and production; 16-page technical section outlines important features of equipment plus supplementary reference material and data such as charts and tables. Blue M Electric Co., 138th and Chatham St., Blue Island, Ill. **L-9-15**

Hydraulic Grinders

Revised 20-page Catalog B-571 describes and illustrates lines of plain hydraulic cylindrical grinders emphasizing exclusive features and advantages; includes complete specifications and shows close-up views of work setups. Landis Tool Co., Waynesboro, Pa. **L-9-16**

Coil Calculator

Most desirable coil weight considering coil handling equipment available can be quickly calculated by a coil weight and length calculator which requires the user to know only inside and outside diameter of the coil and the width and thickness of the stock; all calculations are automatic and easy to achieve. Figures shown on the face of the calculator are for steel coil stock. Aluminum coils can be calculated by taking one-third of the weight figures; brass stock by adding 10 percent to the steel weight figures. F. J. Littell Machine Co., Publications Div., 4101 N. Ravenswood Ave., Chicago 13, Ill. **L-9-17**

Marking Tools

Reference catalog presents company's line of marking tools which includes hand stamps, code stamps, lettering dies, knurls and interchangeable type; gives nomenclature and a summary of how various tools are used, and outlines how-to-order information. Geo. T. Schmidt Inc., Dept. TE, 4100 Ravenswood Ave., Chicago 13, Ill. **L-9-18**

Welding

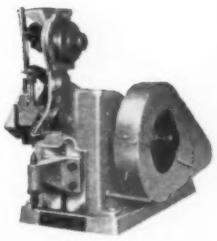
Six-page folder 5205.1 explains important features, uses and advantages of Lincoln ML-3 "Mechanized Squirt Welder" for submerged arc welding; well illustrated. The Lincoln Electric Co., Cleveland 17, Ohio. **L-9-19**

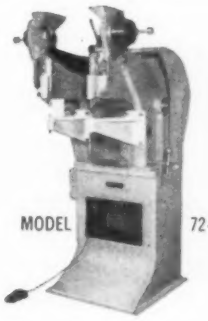
Workholders

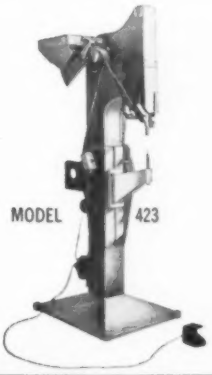
Comprehensive 24-page catalog of DTC and Burnerd workholding devices describes each model and type in detail and outlines specifications and dimensions; illustrated. De Witt Equipment Corp., 190 Elizabeth Ave., Newark 8, N.J. **L-9-20**

Magnesium Tooling Plate

Magnesium tooling plate properties, use of magnesium extrusions in tooling, shop characteristics of magnesium alloys, machining instructions, grinding and polishing, joining, inserts and bushings, surface protection and good shop practices covered in 55-page shop manual; appendix gives standard sizes of round and square magnesium tubing, equal angles and I-beams. Request only on company letterhead direct from Magnesium Dept., The Dow Chemical Co., Midland, Mich.


MODEL 52


MODEL 72-DP

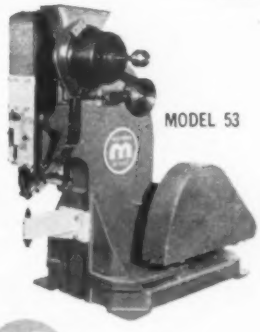

MODEL 423

CUT ASSEMBLY COSTS...

with Milford's complete riveter line

Bench or Pedestal Models
Single or Multiple Spindle
Automatic or Manual Operation

Milford Rivet-Setting Machines can be adapted to solve nearly every fastening and assembly problem. Count on Milford's versatility and ability to come up with the right answers at substantial cost savings. To take full advantage of automatic assembly— get in touch with Milford first!


MODEL 53

MODEL 250

THE MILFORD RIVET

MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • HATBORO, PENNSYLVANIA
ELYRIA, OHIO • AURORA, ILLINOIS • NORWALK, CALIF.

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Sealing Rings

Comprehensive 8-page brochure on performance and use of metallic sealing rings points out their engineering advantages; illustrates and defines four major types of sealing rings plus discussion of combinations of materials used in rings; drawings show typical applications; includes 4-page specification table on most widely used rings. Publications Section, Koppers Co., Inc., Metal Products Div., 200 Scott St., Baltimore, Md. **L-9-21**

Ultrasonic Cleaning

Illustrated 24-page Bulletin S-200, "Ultrasonic Cleaning," explains practical applications and basic principles of this cleaning method, and discusses its advantages; also describes design of equipment used in the process, lists requirements and specifications and supplies data on many types of equipment, parts and accessories made by the company. Dept. TE, Branson Ultrasonic Corp., 40 Brown House Rd., Stamford, Conn. **L-9-22**

FEED UP TO 12" PER PRESS STROKE!

Never before such press feeding ACCURACY... such simple compactness!

A "standard" off-the-shelf Rol-Di-Feed so versatile, so economical, it will save hundreds of dollars—do the most rugged press feeding jobs without wonder, worry or waste!

Compact—YES! . . . feeds front to back, back to front, right to left, left to right—and *diagonally!*

That's Versatility plus! A new 12" feed, a new feeding principle, a new profit in *your* press feeding operations!

Dickerman

H. E. DICKERMAN MFG. CO.
321-411 Albany St. • Springfield, Mass.

Send for literature—have a Dickerman Representative call. Would you like a demonstration on *your* material?

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Diamond Grinding Wheels

Twenty-page catalog, Form ESA-290, shows dimensional drawings, specifications and prices for complete line of diamond wheels and hones utilizing both man-made and natural diamonds. Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 37, Pa. **L-9-23**

Drilling and Tapping

Numerous engineering drawings plus photos illustrate 28-page Bulletin 5810 on HyPneuMat air or hydraulic powered automatic drilling and tapping units; describes each model in line, shows basic construction, outlines advantages and lists specifications; includes prices. Hypneumat Inc., 647 W. Virginia St., Milwaukee 4, Wis. **L-9-24**

Drill Bushings and Inserts

Sixteen-page brochure discusses uses of inserts and drill bushings and outlines important features and advantages; drawings and photos illustrate various points; includes specifications tables and drawings for each type. Revere Fisher Engineering, Div. of North Branch Products, Millington, Mich. **L-9-25**

Arc Welding

Written in nontechnical language, 24-page booklet, "Reducing Costs by Proper Care of Arc-Welding Circuits," points out many things that can be done to keep electric arc welding circuits operating properly. Hi-Amp, Lenco, Inc., 350 W. Adams St., Jackson, Mo. **L-9-26**

Press Brake Dies

Illustrated 4-page folder shows operation of Rol-Form dies for punch presses and explains their uses and advantages; includes cost tables. O'Neil-Irwin Mfg. Co., 414 Eighth Ave., Lake City, Minn. **L-9-27**

Positioning Tables

"How to Reduce Costs and Improve Precision in Circular Spacing and Angular Positioning" discusses use, operation and advantages of rotary tables for inspection, machining and graduating; well illustrated. Pratt & Whitney Co. Inc., West Hartford 1, Conn. **L-9-28**

Paint Removal

Four commonly used methods of removing paint described in detail in 8-page Booklet F7893; describes 12 different paint stripping compounds then discusses hot-flow on, tank immersion, steam gun and brushing methods of removal; also discusses treatment of metals before repainting and prevention of rust on stripped surfaces in storage. Oakite Products, Inc., 158 Rector St., New York 6, N.Y. **L-9-29**

Couplings

Standard line of quick-connect, quick-disconnect couplings presented in spiral bound 25-page general Catalog; extensively illustrated to show main features; special section explains use of pressure drop and flow charts. Snap-Tite, Inc., Union City, Pa. **L-9-30**

Welding

Combination a-c, d-c and inert-gas welding machine described in 4-page illustrated folder, DM-71; emphasizes important advantages of single welder for all three types of work. Hobart Brothers Co., Troy, Ohio. **L-9-31**

Selenium Rectifiers

Illustrated 8-page brochure on vacuum process selenium rectifiers gives complete descriptions, data and specifications for company's rectifier plates and stacks and for cartridge type rectifiers and stacks. Syntron Co., 340 Lexington Ave., Homer City, Pa. **L-9-24**

Lubricant

Leaflet explains describes Litholine industrial greases, explains their properties, advantages and uses, outlines application and performance characteristics and lists specific applications. Sinclair Refining Co., Technical Service Div., 600 Fifth Ave., New York 20, N. Y. **L-9-33**

Flat Stock

Bulletin No. 1110 describes No. 498 Free Machining, low carbon precision ground flat stock; lists sizes available and gives suggestions for use, specifications and heat treatment instructions. The L. S. Starrett Co., Athol, Mass. **L-9-34**

Induction Heating

Issue No. 3 of Induction Heating "Review" presents articles on various facets of high frequency induction heating; drawings illustrate special points. Lepel High Frequency Laboratories, Inc., Woodside, N.Y. **L-9-35**

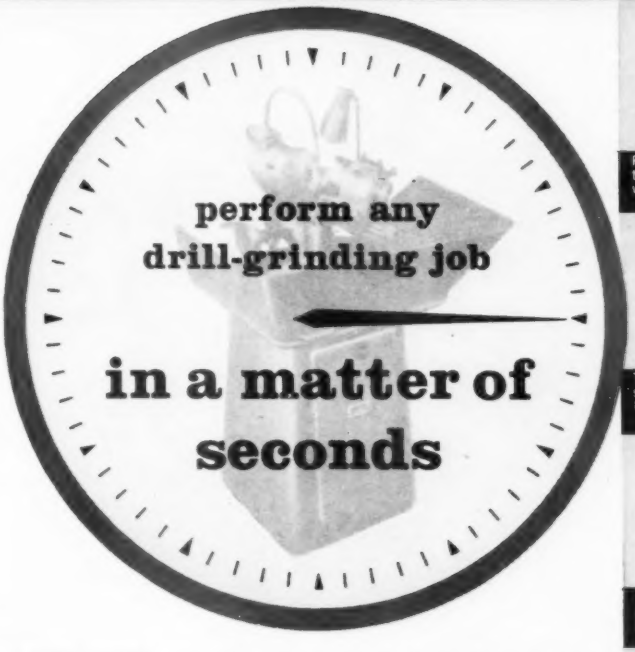
Filters

Extensively illustrated by photos and drawings, 132-page filter engineering and application reference manual provides information of filters for aircraft, missiles, industrial and ground support equipment; describes equipment for lubricating oils, hydraulic fluids, compressed air and gases, etc.; 14-page section outlines history of filtration and also includes subject, quick-reference and numerical parts indexes; also discusses particle sizes, and basic filter media. Request only on company letterhead direct from Bendix Filter Div., Bendix Aviation Corp., 434 W. 12 Mile Rd., Madison Heights, Mich.

new, revolutionary

ALINA SELECT-O-POINT

drill grinders



Right hand twist drill, with centre

Twist drill for soft material, lips corrected

Three-flute drill (core drill)

Spot facing cutter, countersink angle 60°

Screw tap, grinding of the angle of rake

Designed for rapid and accurate grinding of:
Keyway Milling Cutters • End Mills
Spot Facing Cutters • Screw Taps
Twist Drills • Step Drills • Reamers, etc.

Three models to choose from — *No. 01-2 Range .004" thru .080"—No. 03-6 Range .012" thru .240"—No. 2-32 Range .093" thru 1.250".* Each machine is a complete system built around a *planned drill point.* Applied to twist drills, this new drill point will increase the useful life of your drills — reduce the drill thrust force — eliminate the need for center punching — produce a rounder and more accurate hole — and on the larger drills afford you a drill point that will produce a round and almost burr-free hole in sheet metal. Fully variable adjustments may be accomplished with a minimum of effort; settings once selected may be altered or repeated *exactly* at any time. Accuracy and simplicity is built into each machine.

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ALINA CORPORATION

122 East Second Street, Mineola, Long Island, New York

Alina Corporation, 853 East 8 Mile Road, Detroit 20, Michigan
Jerico, Inc., 4744 West Lake Street, Chicago 34, Ill

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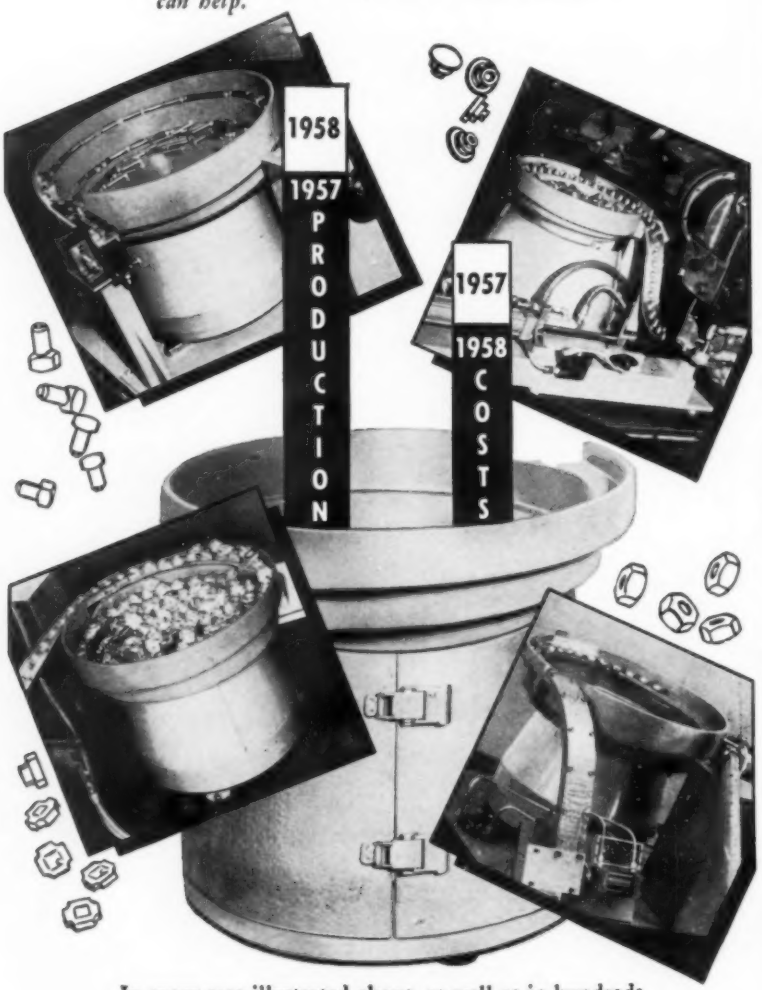
the shortest route to MORE PROFIT
. . . produce MORE in 1958!

If you can reduce costs while producing more, the job is twice as easy. This is where PEECO can help.



In every case illustrated above, as well as in hundreds of other examples, PEECO successfully helps production men reduce their costs by producing more—automatically.

If your equipment, machinery, production or assembly line is *not* now using parts feeders the chances are your costs are too high. Let a PEECO Sales Engineer give you the facts. He'll gladly help you without obligation. Write for literature and name of representative near you.

We'll be watching for you at the TOOL SHOW—Booth 1414.

THE WORLD'S LARGEST EXCLUSIVE MANUFACTURER OF VIBRATORY PARTS FEEDERS

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good READING

CERAMIC FABRICATION PROCESSES—*By W. D. Kingery, Editor. Published jointly by The Technology Press, M.I.T., and John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price $9.50. 235 pages.*

With the increasing interest in ceramics for high-temperature applications, this book will prove useful to the engineer making a study of the ceramic process. It is the outgrowth of a special summer program in ceramics at M.I.T. Authors of each section participated in the program and are outstanding scientists and engineers writing about his particular area of interest in the ceramic fabrication field.

Ceramic fabrication has been divided into five main areas including slip casting, pressure fabrication, plastic forming, drying and firing and special processes. In the slip casting area, the basic chemistry as well as plaster molds, particle sizes and nonclay ceramics are covered in detail.

In the special processes section are included hot pressing, continuous bonding, microstructure effects on properties and nucleation. Another area of interest to tool engineers is the possible application of metalworking processes to ceramics.

AUTOMATION IN PRACTICE—*By S. E. Rusinoff. Published by American Technical Society, 848 E. 58th St., Chicago 37, Ill. Price $6.50. 261 pages.*

Automation has different connotations in various parts of the country and has been thought to apply only to large manufacturing operations. In this book, the author leads the reader into the concepts of automation and use in smaller plants by building on fundamentals of hydraulics, pneumatics, electrical and automatic control. The discussion proceeds into more complex materials handling and machining proc-

esses to specihc applications in various industries. Clear illustrations make comprehension of the principles easy for the student or anyone requiring information about automation.

Division of the book is into two parts which include control devices in the first section and applications in the second. Applications include use of automation in materials handling, production of metals, metal casting, mechanical and press working of metals, metal-cutting operations, heat treat and quality control.

GRAY IRON CASTINGS HANDBOOK—*Edited by Charles F. Walton. Published by the Gray Iron Founder's Society, Inc., Cleveland, Ohio. Price $10.00. 620 pages.*

With 90 percent of the metalworking companies using gray iron castings in their manufacturing processes, this handbook on this material should be useful to engineers, manufacturing personnel and students. For the designer, there are suggestions to help translate a projected design into an economical and easy to produce finished product.

The production executive will find guides to the selection of tool materials as well as heat-treat methods and finishing operations. Other general information relates to how improved gray iron enables management to produce products more economically.

The chapter on specifying and purchasing of casting covers the technology necessary to judiciously purchase castings. Basic types of foundries, the various casting processes, the types of patterns and core boxes are described in easy to understand terms, as well as being shown in many pictures and drawings.

An extensive bibliography at the end of each major section presents sources of information on the material covered in the section, such as heat treatment—130 listings.

SAFETY DEVICES AND IDEAS. *Books 1 & 2—Published by the National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill. Book 1, 47 pages. Book 2, 46 pages. Price $1.40 each.*

The two booklets outline many safety ideas used by companies to prevent accidents. Over 200 ideas are illustrated including examples of machine guards, fluorescent tube guards, collapsible handrails and other useful items for most manufacturing plants.

position or feed it faster

WITH AN AUTOMATIC

Feedall

hopper-load elevating feeder eliminates costly hand operations, saves time and speeds parts flow

SPECIFICATIONS—*Model 3000 Elevating Hopper Feed*

FEED RATE: variable speed drive to match production rate of machine being fed.

WORK RANGE: rolling parts, 1" to 6" in diameter, 1/8" to 2" in length. Sliding parts, 1/8" to 2" in diameter, up to 6" long. Loading height is 62".

CAPACITY: 18 or 25 cu. ft. hopper. Overall floor space is 48" x 52".

DELIVERY ANGLE: 15° rolling parts, 30° sliding parts. 10° elevating angle.

DRIVE: 3/4 hp, 220/440V 60 cycle, three phase motor.

This multi-purpose feeder is just about the most versatile machine ever developed by Feedall. It provides in-process storage; elevates, orients and feeds work-pieces of wide variety in diameter and length. It handles both rolling and sliding parts. Typical are the varied parts shown above, merely suggesting the many versatile uses for this high-production unit.

It's fully automatic. Model 3000 replaces slow, time-wasting hand feed. The combination of magazine-loading and selectable speed permits continuous parts flow at any desired rate. *It's compact.* The "complete-package" feeder is entirely self-contained and is simple to fit into existing facilities. *It's a producer.* Model 3000 has proved its reliability and profitable operation in scores of installations. Construction is rugged; built for multi-million cycle operation.

Useful features of the Model 3000 include: electronic controls for any timing cycle, readily adaptable design to fit many special feeding jobs, portable and simple to re-locate, and adjustable elevating angle for special purposes.

Eliminate hand-feed, save operators and step-up production . . . with a Model 3000 Feedall. Full details are available in latest catalog, complete with estimating data sheet. Write for your copy today. Or if you have a special feeding problem, send us sample parts and brief data. We'll do the rest, promptly.

Feedall *Producers of automatic feeding devices*
FEEDALL, INC., WILLOUGHBY, OHIO

ELEVATING, BLADE, TUMBLE, VIBRATORY FEEDERS • TRANSFER AND ELEVATING CONVEYORS • SPECIAL SELECTOR DEVICES
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THIS
INGENIOUS
MACHINE TOOL
JUST
SIXTEEN
INCHES
AND YOU'VE GOT IT MADE!

precision
workshop-in-miniature
saves time and money

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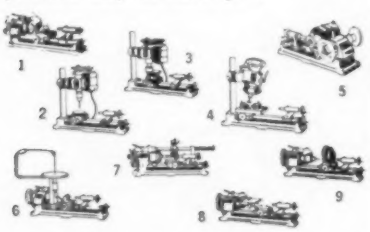

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TOOL ENGINEERING in Europe

By M. Kronenberg
Consulting Engineer
Cincinnati 6, Ohio

Electroerosive Machining

Electroerosive machining methods have made rapid progress during the past few years, as indicated in a booklet of 88 pages authored by J. S. Spizig and published by Deutsche Verlags Anstalt Stuttgart under the title: *Der gesteuerte elektro-erosive Metallabtrag.*

The hardest carbides and high-temperature alloys become machinable under the high temperature of the spark, although metal removal by these methods is economical only when the conventional methods fail. All methods considered have in common the conversion of electrical energy at the point of machining. In contradistinction to conventional metal-cutting or metal-forming methods, no mechanical energy is expended at that point.

The author says that electroerosive methods represent the final stage in the development of metal-cutting because the conversion of electrical energy into mechanical energy is by-passed. Accuracy depends directly on the time spent and is defined as conformity of the shape of the final product with the shape of the electrode. The booklet contains numerous details on the various methods and American and European machines are described.

Broaching Tool

Better chip breaking in broaching operations is obtained by grinding the individual cutting edges in a chordal form, according to a short article published in *Overseas Post*, edited in cooperation with the Association of German Engineers (VDI). The method, developed by K. Klink and described by H. Cornely in the March, 1958, edition, consists of subdividing each broach tooth into several sharpened portions. Individual teeth are staggered so that the sum of the remaining cutting edge portions broaches over the entire cir-

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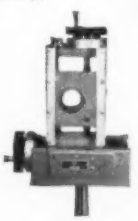

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cumference of the hole. All cutting edges on the same tooth have the same diameter. Each succeeding tooth is increased in diameter in the same proportion as on conventional broaching tools so that the length of the new broach is approximately the same as the length of a conventional broach.

Jig Boring and Milling Machine

An automated jig boring and milling machine made in Western Germany is described in the same issue of *Overseas Post*. All motions are electrohydraulically controlled, making it possible to perform drilling, countersinking, boring, facing, tapping and milling in one setting. The setting time for locating the workpiece is reduced by a new compound table. Up to 28 cycles, such as positioning of the spindle, rapid spindle advance to preselected positions, engaging the preselected rpm of the spindle and of the feed, stopping the spindle, disengaging the feed, withdrawing the spindle, repositioning the spindle, etc., can be controlled. The machine is equipped with punch-card control. The cards are punched according to specifications on engineering drawings.

Effect of Hydrogen on Welding Steel

An article published by K. L. Zeyden in *Werkstatt und Betrieb*, No. 6, 1958, under the title: "Neuere Erkenntnisse ueber den Einfluss des Wasserstoffes bei Staehlen und bei Stahlschweissungen" covers the development of research work carried out all over the world on the effect of hydrogen on the welding of steel. The article was published at the suggestion of the International Welding Institute and is a survey of the various research publications in this field. One hundred publications are analyzed and compared.

The author subdivides the work into several chapters: the effect of hydrogen in steel and the methods for determining this effect; the effect of hydrogen on welding of steel and of the methods for measuring these effects; the effect of humidity of electrode coatings on welding performance; and new coatings for electrodes. The work of the two IWI sub-committees: A (hydrogen) and B (arc welding) is also described. This work was done in connection with the annual meetings in Madrid and Essen.

Ceramic Tools

Data on the use of ceramic tools, based on tests, are given in an article by W. Dawihl and E. Klingler in *Zeitschrift des Vereins Deutscher Ingenieure*, No. 13, 1958, under the title: "Standzeit und Wirtschaftlichkeit oxyd keramischer Drehwerkzeuge." The authors recommend feeds up to a maximum of 0.040 ipr. They found that tool

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life is little affected when the feed per revolution is varied between 0.004 and 0.016 inch, while the tool life drops in cases where the feed exceeds 0.016 ipr.

They suggest that depth of cut be limited to a maximum of about 0.20 inch because tool life decreases substantially at greater depth of cut. Cutting speed recommendations for machining of carbon steels cover a range of about 300 to 1000 fpm, while 250 to 750 fpm are recommended for machining of alloy steels. The same speed range is suggested for cast iron as for alloy steels, while speeds of 150 to 450 fpm may be used for machining chilled cast iron.

Negative true rake angles of −5 to −6 deg, clearance angles of about 6 deg and angles of inclination of 5 to 6 deg have been found to give the best performance. Positive true rake angles, however, can also be used successfully on ceramic tools, with a reduction in horsepower requirements. Grinding a flat at about 30 deg across the cutting edge is useful for those portions of the cutting edge that are not in engagement with the work and represents a means for protecting the free portion of the cutting edge from the chips.

The temperature gradient extending from the cutting edge to the heel of the crater (where the chip leaves the tool) is greater with ceramic tools than with carbides; the authors indicate that this greater gradient is the cause of the lower temperature at the gap between tool tip and holder. Built-up edges have been found on ceramic tools by Dawihl and Klingler and they recommend regrinding the tools or disposing with throwaway tips when the wear land on the flank has reached a width of about 0.020 inch.

A portion of the article deals with the economical side of cutting speeds and another one with a theory of tool life. The authors recognize two effects of cutting speed on tool life: one increasing the wear of the tool and the other reducing the wear, and come to the conclusion that an increase in tool life may be possible at ultrahigh cutting speeds. This conclusion is interesting in conjunction with the discussion by this writer of several papers presented at the 1958 Annual Meeting of ASTE and with research being carried out in American industry.

Machining of Titanium

Chemical and physical properties of titanium are listed and various machining methods discussed in an article by H. D. Weckener in *Industrie Blatt*, 1958, vol. 58 (4), pp. 119-123. The article is published under the title: "Spanabhebende Bearbeitung von Titan" and covers milling, turning, facing, grinding and sawing. Details of speeds, temperatures and equipment are given. High-speed steel and carbides are used for machining.

Hard Facing

A detailed report published by R. Nass and E. Brammertz in the June edition of *Werkstatt und Betrieb* deals with hard facing of copper alloys on boilerplate by means of automatic argon shielded welding equipment. The title is: "Erfahrungen bei der Sigma-Auftrags Schwiessung unter Argon Schutzgas und bei der Kohlensaeure Verbindungs Schweissung."

It was found that the positive pole of the welding rod gave superior results. The authors report on extensive tests on joint welds of thick plates of different qualities, carried out with automatic welding equipment. The favorable results made it possible to obtain official approval of this process for the manufacture of boilers and similar machinery. The effect of the process on the health of the operator has also been investigated and it was found that no danger exists when the required precautions are taken.

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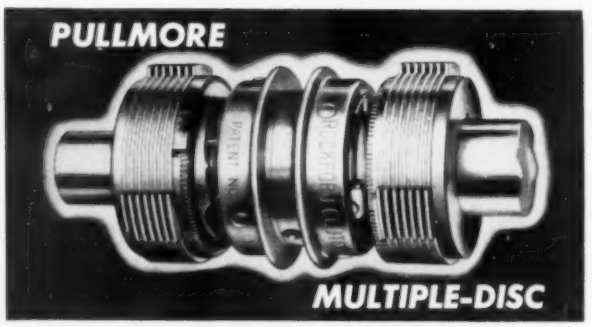

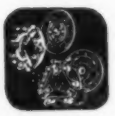
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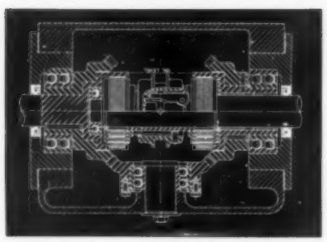

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Readers' Viewpoints

. . . barrel finishing

To the Editor:

In regard to Mr. S. L. Shafer's letter I am impressed, and quite happy to learn that 90 percent of "Automatics" parts can be produced without burrs. My experience, in more than one shop, has not proved so effective.

I am glad that burrless parts can be produced because, like many other people interested in cost reduction, I would rather eliminate secondary operations, altogether, than to be compelled to provide even so effective and economical deburring operations as barrel finishing.

But, until all are informed on producing burrless parts, I feel that as many tool engineers as possible should be informed on the more economical deburring methods.

Ralph Enyedy
Industrial Engineer
Electronic Tube Div.
Westinghouse Electric Corp.
Elmira, N. Y.

To the Editor:

In our opinion, the statement made by Mr. Shafer to the effect that "approximately 90 percent of such parts as the two shows can be dropped off a screw machine completely deburred" is substantially correct. The utilization of standard attachments available on screw machines and employments of other ingenious devices developed by the users of these machines have practically eliminated the need for second operation deburring in the manufacture of the particular parts described. However, there are a great many parts produced in screw machines that do not fall in this category, and the use of barrel finishing is an effective, economical method of deburring.

In our factory, both methods are used and can be economically justified.

Mr. Shafer's complaint to the effect that "people in captive shops haven't the know-how to produce this type of piece without burrs" is a little farfetched. It is our experience that ingenuity as applied to the operation of automatic screw machines is about evenly divided between so-called "captive shops" and "job shops." There are examples to be cited of excellent operation in both. By the same token, there are others that leave something to be desired.

Anonymous

. . . automation curriculum

To the Editor:

In regard to the specialized courses suggested in Prof. Linsky's article in a recent issue on "Professional Education for Automation Engineers," I disagree with him on their need. An engineer is one who can direct a force by mechanical, hydraulic or electrical means. When we think of a student, we conceive of a man spending hours and money in preparation for doing his part in the world. With few exceptions, he is putting forth sincere effort. Therefore, he should be guided into basic information courses, and conversely, he should be directed away from "glorification" courses.

We see them advertised—"Be a Diesel Engineer"—"Make Big Money"—"Be a Television Expert." These schools may have a place in the training of technicians for a particular field. An engineer can apply the basic rules of physics to the diesel motor or the cheapest alarm clock, using the language of mathematics.

Whether a man designs a product, a jig, a machine or establishes a process, he does it, one line at a time, and bases his action on precedent or the laws of mechanics. If he makes an analysis, he must follow the rules of observation and careful interpretation as learned in laboratory practice.

An automation engineer is not wanted from the colleges! Primarily it is unfair to the student. It is tough comprehending fundamentals with examples of their use. If he can gather under his bonnet the concepts of physics, mathematics, electricity in the alloted time and remember he is a human being, he will be useful to society and to himself.

Ralph W. Callender
Process Engineer
International Harvester Co.

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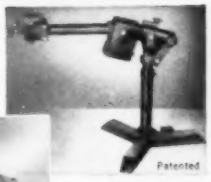
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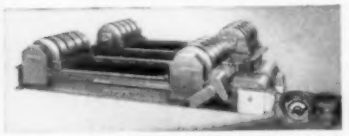
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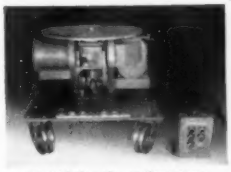
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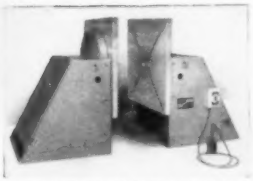
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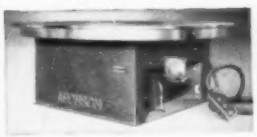
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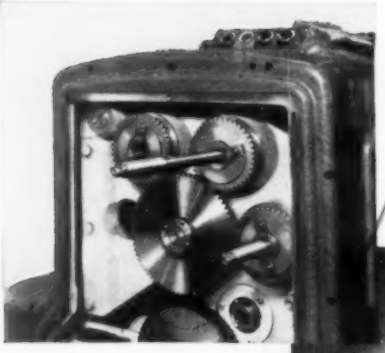

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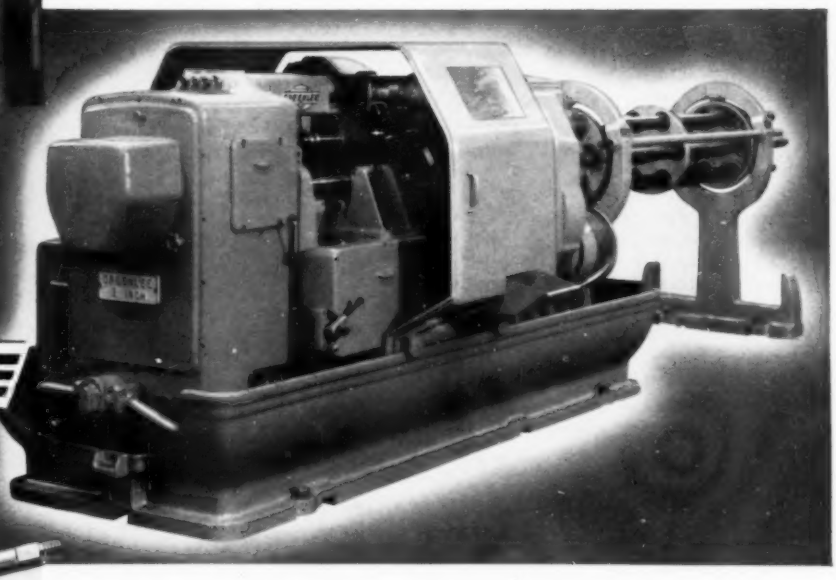

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Tech Digests

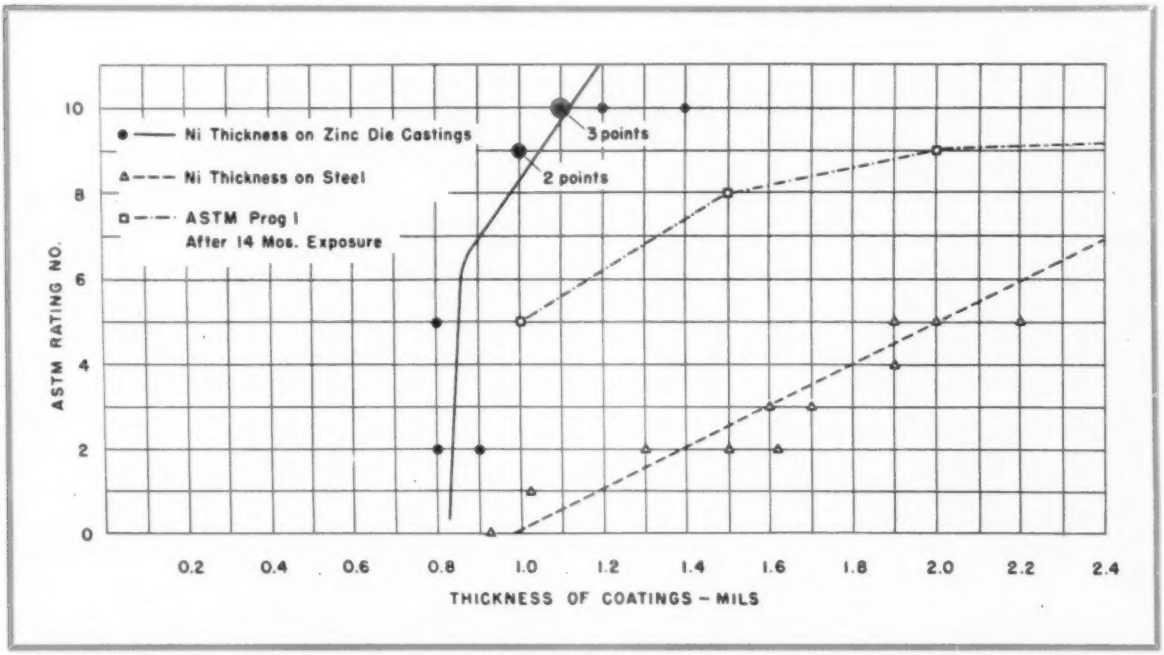
Developments in Decorative Plating

By C. H. Sample
The International Nickel Co., Inc.
Detroit, Mich.

IMPORTANT early highlights leading to the development of modern decorative plating are: (a) announcement of the Watts bath which signalled the beginning of high-speed nickel plating; (b) the invention of bright chromium plating; (c) improved basis metal preparation and cleaning procedures to secure satisfactory adhesion of deposits; (d) the development of specifications for plated coatings including testing methods; (e) the invention of bright and semibright nickel-plating solutions; (f) the development of automatic cleaning and plating machines.

Relatively recent observations with respect to the durability of decorative plating may be summarized as follows: (a) "Double layer" buffed dull nickel chromium coatings provide much better protective value in marine and rural atmospheres than do single layer nickel-chromium coatings of the same total thickness; (b) the protective value of bright nickel coatings under bright chromium is generally inferior to buffed dull nickel of the same thickness when boldly exposed to the weather; (c) increasing the thickness of bright nickel under chromium improves the protective value of the composite; (d) chromium plating bright nickel may have an adverse effect on its protective value; however, increasing the thickness of the chromium from three to six times that normally applied has a marked beneficial effect.

While much of the foregoing is in a sense a criticism of current bright nickel, it is well recognized that even more might be written regarding its merits. Obviously bright nickel plating can perform and is performing a useful and important function in the field of decorative plating. In many applications it is fulfilling its purpose not only without cause for complaint but with laudable merit. Further, despite its somewhat inferior protective value (compared with buffed Watts nickel), in applications involving bold exposure



Test results of AES Project 15 production parts exposed for 10 months at Kure Beach test station. Marked improvement in the protective value was found with increasing nickel thickness, but thicker coatings have given a rather poor account when compared with the buffed dull nickel of test samples used in ASTM B-8 Program 1.

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to the elements, it is most unlikely that industry would be willing because of increased costs, to revert to buffing dull nickel as a base plate for chromium. Finally, with both the producer and the consumer interests cognizant of the need to improve the durability of decorative plating, the industry can confidently expect that through continued research efforts, such as are in progress in the AES research program, ASTM Committee B-8, and the laboratories of many private organizations notable advancements will be forthcoming.

From a paper presented at the SAE Annual Meeting, Detroit, Mich., Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

Increased Productivity and Creativity by Engineers

By T. E. Shea

VP-Engineering
Western Electric Co., Inc.
New York, N. Y.

If industry is to develop more imaginative, dedicated engineers and not possess merely high-grade technologists, it must address itself more pointedly to the essential requirements of professionalism. It has gone far in this direction in its separate organization and treatment of research laboratories and in developing professional breadth and depth in its managers. It now needs emphasis in a difficult field: that of the engineers who are a part of the main stream of its industrial organization. The five areas to consider for insuring better use of engineering abilities are:

1. Relations of engineers to management
   a. Company attitudes and practices in recruiting
   b. Summer employment as an aid to recruiting
   c. The effectiveness of engineering supervisory leadership
   d. The flow of information to supervision for dissemination and interpretation
   e. Direct communication of information to engineers
   f. Contact of engineers with engineering and other managerial leaders
   g. Opportunities for engineers to inquire, discuss, evaluate, and to "gripe" with assurance that ideas will be considered
   h. The soundness of over-all company attitudes toward progressive engineering operations
   i. The stature of management—its dignity, integrity and progressiveness.
2. Training and experience
   a. Assisting engineers in further formal education
   b. In-company educational training programs
   c. Encouragement of self-study
   d. Provision of information on company economics, business, and operating problems
   e. Opportunities to develop skills in communicating and dealing with people
   f. Programs for experience and rotation
   g. Vitality of the engineer's experience and stimulation by his associates
   h. Adequacy of libraries and technical literature
   i. Generation and circulation of technical memoranda
   j. Engineering seminars, exhibitions and conferences
   k. Access to technical ideas and developments in industry
   l. Methods of appraisal of abilities, performance and potentialities.
3. Employment conditions
   a. Adequacy of salary levels
   b. Adequacy and understandability of merit relationship of salaries to performance and potentiality
   c. Special recognition of experienced specialists
   d. Working conditions—space, lighting, ventilation, furniture, etc.
   e. Adequacy of laboratory equipment and facilities
   f. Delegations of authority to engineers
   g. Freedom to pursue creative work (time and conditions requisite thereto).
4. Efficient use of engineers' time
   a. Classification of professional and nonprofessional personnel
   b. Use of nonprofessional assistants and clerks, business and shop support, computers and other technical services
   c. Efficient pooling of combined skills in engineering groups.
5. Professional relations
   a. Relations of engineers to professional societies
   b. Relations of companies to professional societies
   c. Relations with universities
   d. Attendance at technical conventions and society meetings
   e. Publication of technical papers
   f. Company engineering publications
   g. Awards and other forms of individual recognition

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h. Recognition of community contributions
i. Vertical classifications or titles.

From a paper presented at the West Coast General Management Conference, American Management Association, San Francisco, Calif.

▼ ▼ ▼

Engineer-Retention

By J. D. Staley
Assistant Div. Mgr.
American Management Assn.
New York, N. Y.

It has been fashionable for some years to complain about shortages of engineers, scientists and professional people. Companies are setting goals of "x" or "y" engineers to be recruited, while colleges and technical institutes are warning business that they (the educators) cannot possibly train enough men to meet the demand. Some firms, who seem to be adequately staffed, are looking for an extra man, the "rainy day" engineer, because they heard all the talk about their being hard to get. In some cases, as much as half a company's requirements were for filling new jobs. Perhaps 50 percent, however, were for jobs which were opened due to turnover. One company is reported to have spent over $900,000 recruiting and relocating 193 engineers, but in the same period lost 134 to other companies—scoring a net gain of only 59 men. In the current lull in industrial activity, with car loadings down, new orders at a low ebb, and sales dollars hard to come by, some companies have placed somewhat less emphasis on these problems. They'll be with them again, however, with any forthcoming upswing in industrial indexes.

Look, for example, at what "progressive" companies are doing. Here, for instance, are some comments made by a research executive.

"We constantly try to upgrade our men . . . increase their ability . . . provide them with more information relating to their work . . . Similarly, we encourage active participation in technical societies."

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Based on a paper presented at the Semiannual Meeting, Detroit, Mich., June 15-19, 1958 of The American Society of Mechanical Engineers, 29 W. 39th St., New York 10, N. Y.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Continuous Radiotracer Monitoring Shows How Piston Rings Wear in Service

By J. S. Batzold
J. V. Clarke, Jr.
J. F. Kune

Esso Research and Engineering Co.
New York, N. Y.

A radiotracer study, to obtain a better understanding of the factors governing wear, was conducted in a passenger car, the engine of which had radioactive top compression rings. Wear was determined by monitoring the crankcase oil for radioactive iron originating from the piston rings. The test vehicle was equipped so that the crankcase oil could be monitored for radioactivity continuously while the car was operated. The wear rates obtained in this study were of the same order of magnitude as those observed in actual passenger car service, demonstrating that significant results in terms of field performance can be obtained by running wear tests of relatively short duration with radioactive rings.

The study revealed that a variety of interrelated factors have an important

bearing on piston-ring wear in passenger car service. These include (a) the operating regimes to which the vehicle is subjected, (b) the temperature of the cylinder walls, (c) the amount of dirt

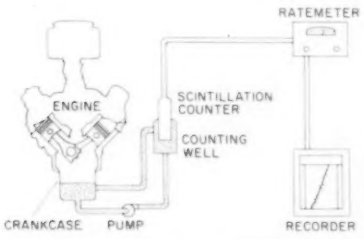

Fig. 1. Schematic diagram of test equipment.

getting into the engine, (d) the kind of fuel burned and (e) the kind of lubricant used. The study conclusively demonstrated that the radioactive piston-ring technique is a powerful research tool for delving into and resolving the many-faceted and complex problem of piston ring wear.

Editorial Note: while this information is not directly related to tool engineering studies, the techniques are interesting where wear or rate of wear is a factor. The illustration shows the experimental setup which could be used where the workpiece or tool is being worn away, and a fluid used for cooling or washing.

From a paper presented at the SAE Annual Meeting, Detroit, Mich., Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

▼ ▼ ▼

Only the Strong Shall Remain Free

By Ludlow King
Executive Vice President
National Machine Tool Builders Assn.

While thumbing through the usual myriad of reports, I noticed one from Washington which seemed of no real concern to the U. S. machine tool industry. In essence, it said that the Director of Defense Mobilization has decided that the watch industry need not be protected by tariffs. Department of Defense study concluded that the industry is not essential to the supply of items critically needed by the military. Also, imports of jeweled and pin-lever watches and clocks are not threatening the national security.

Was it, or was it not, of real concern to me? The more I thought about the matter, the more positive I became it was of eminent interest to all of us.

I had previously heard that a member of our State Department admits "certain sacrifices" must be made in carrying out our governmental administration blueprint for a "World Trade Program." Was the Washington report indicative of what was meant by "certain sacrifices?" Could the over-all strategy of the governmental planners include such serious dislocations as shifting an entire industry to foreign countries? Apparently so.

It is well to remember how important the watch industry was during World War II when its highly trained and skilled labor forces produced the mechanism for our proximity fuses. With the rapid technological advances now being made, who can say categorically that the watch industry could not fulfill a similar role and again aid in the protection of our country in the future? However, now, for all practical purposes, it is being destroyed because we

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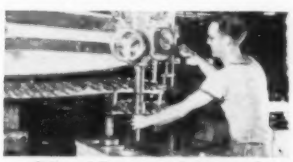

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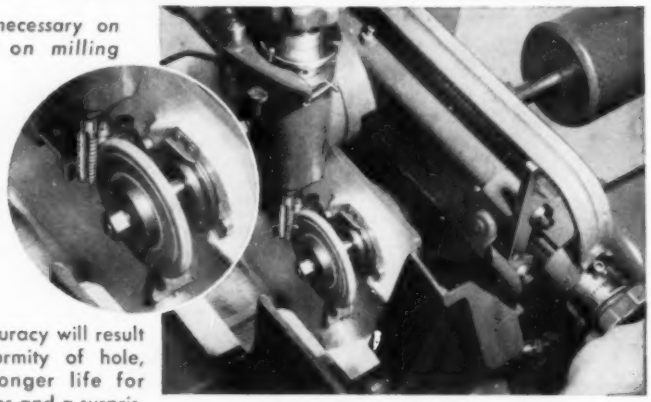

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cannot build watches in this country as cheaply as foreign countries with their low level of wages.

This makes me wonder: What can we manufacture in this country on a competitive basis with import articles produced at wages which are only a fraction of those paid in this country to support our high standard of living? Consider only the defense of our country, nothing of a political or international relationship nature.

If we start sacrificing industries such as the watch, bicycle and textile, in this piecemeal manner, where will our commitments eventually lead us? You can sink a ship either by blowing it up in one blast or by drilling holes in the bottom.

Who rejected the watch industry? Not, which agencies went through the ceremonies purely to add formality to the act; but who is responsible? How many other industries will be lost in like fashion, and how many Americans will be thrown out of work in pursuit of this trade agreement plan?

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

It's a well-recognized fact that our wages have spiralled so high, with the apparent blessing of government, that dozens of our U. S. industries must pay more to produce items than foreign countries which do not enjoy our high standard of living. Will they all go the way of the watch industry? Of greatest importance, what will these losses really mean to our National Defense?

Our government is courageously pursuing an ideology which is most commendable. The purposes and goals are beyond reproach. The National Machine Tool Builders' Association is strongly in favor of establishing sound trade agreements with foreign countries, provided they are mutually beneficial. We are against any "one-way" deals and do oppose reciprocal trade agreements where we are swapping horses for horse chestnuts. Such negotiations will drain the vitality from our ability to defend this great country of ours.

In a recent report prepared by the Attorney General concerning "Expansion of Machine Tool Industry," it is

clearly and emphatically recorded:

> "Machine tools are indispensable to a modern industrial economy. Mass production of metal goods, whether automobiles or tanks, refrigerators or jets, stoves or missiles, is possible only with machine tools or equipment previously made on machine tools."

The importance of the U. S. machine tool industry is apparently well understood by our government; and if it is dedicated to retaining a strong national defense, the health of our industry is imperative.

From an address presented before the Thirty-Fourth Spring Meeting of the American Machine Tool Distributors Assn., New Orleans, La., March, 1958.

▼ ▼ ▼

Protective Atmospheres for High-Temperature Bearing Operation

By C. H. Bailey
S. S. Sorem
and
A. G. Cattaneo

Shell Development Co.
Emeryville, Calif.

To operate ball and roller bearings at high temperatures, the bearing is surrounded with a reducing atmosphere to prevent destructive oxidation, and lubricating films are formed on the bearing surfaces by means of reactive compounds added to the reducing atmosphere. An Air Force sponsored research program is now under way to further develop this method and determine the range of conditions where it may be usefully applied. It has been found that the lubricating film-forming reaction will not go satisfactorily with certain metals frequently used in high-temperature bearing construction. However, bearings constructed of all-ferrous metals do work with this method. To date test runs of 100 hours at 700F and 22 hours at 840F have been completed without any signs of impending bearing failure.

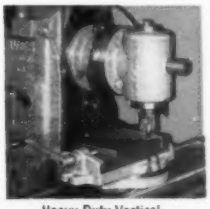
Test results show that the protective functions of a conventional liquid lubricant, which permit a rolling element bearing to operate without excessive surface deterioration, can be performed at elevated temperatures by a properly designed vapor mixture. This method of bearing operation has been called "protective atmosphere" operation.

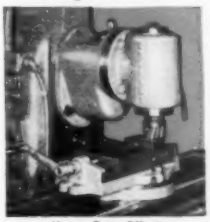
It may be seen that "protective atmosphere" presents a potential method for operating equipment in temperature ranges where lubrication is now extremely difficult if not impossible. Considerably more work will be required to define the optimum combinations of materials and mechanical configurations for use with this method. However, in its present stage, it is sufficiently promising to justify an investigation of its practical limitations with respect to bearing temperature, speed, load and life. However, a few data listing the test durations and conditions where experimental work has successfully been carried out are shown in TABLE 1.

To review briefly, the "protective atmosphere" method for operating rolling

Table 1—Protective Atmosphere Results at High Temperature

Period of Operation (hours)	Bearing Temperature (F)	Bearing Speed (rpm)	Radial Load (lb)	Bearing Size (No.)	Bearing Condition Upon Completion of Test
22	840	10,000	87	206	Good—much longer operation possible
100	700	10,000	20	206	Good—much longer operation possible
22	800	10,000	20	206	Good—much longer operation possible
33	700	7,200	1,000	209	Good—slightly worn


Heavy Duty Vertical Milling Attachment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element bearings at high temperature involves the following concepts: (1) Surrounding the bearing with a reducing atmosphere to prevent destructive oxidation during operation; (2) the in situ formation of lubricating films on the bearing surfaces during operation (for best results these films include both the reaction product of an extreme pressure element, such as sulfur, with the bearing surfaces and an organic film of an as yet undefined composition); (3) the metals of bearing construction having a positive oxidation potential to accept the lubricating films.

From a paper presented at the Annual Meeting, Detroit, Mich., Society of Automotive Engineers, 485 Lexington Ave., New York 17, N. Y.

The New Frontier–Space

By Gilford G. Quarles, PhD
Consultant to Commanding General
Army Ballistic Missile Agency
Huntsville, Ala.

The basic value of the early earth satellites is much more than merely demonstrating the launching capabilities. In its more refined form, the satellite is first of all a research vehicle to give necessary data on the environmental conditions of outer space; that is, information as to the temperatures, the effects of ultraviolet and cosmic rays, the seriousness of impact from meteors, etc.

For a long time, there has been no question in the minds of the senior missile and aircraft experts of the world that travel beyond the confines of the earth and its atmosphere is technologically possible. There seems to be little question that a rocket could be designed and built now to land a small payload on the surface of the Moon. The problem of designing and building one of sufficient size to carry a manned vehicle to the Moon or around the Moon is a somewhat larger undertaking. There is wide disagreement as to whether the first space ship should be directed toward the Moon or toward Mars.

For actual flight into outer space, the generation of the rocket thrust by heat from chemical reactions is very uneconomical. There are three other methods that have been considered. In the first of these, a gas is accelerated by heat energy from nuclear reactors, from electric arcs, or from the sun. In the second, the propellant is converted to ions which are accelerated by electrical fields. In the third, photons are emitted creating thrust because of the momentum imparted to the ship on emission.

TO REQUEST COMPLETE PAPERS WRITE TO THE ADDRESS AND ORGANIZATION INDICATED AT THE END OF EACH ABSTRACT

Each of these ion thrust chambers would have a diameter of about one inch and many thousands of them would be needed to produce the thrust required for the space ship. The chambers would be tightly packed so that the neutralization of the ions occurs at a distance of about one inch behind the thrust chambers.

Having the potential for interplanetary travel within our technological grasp, it is interesting now to speculate on the potential for interstellar travel. A brief consideration of the propulsion problem indicates that such a trip is not now feasible because of the large masses required for propulsion by available means. Such a trip will have to await the technological break-throughs necessary to render the photonic propulsion system feasible.

We thus find ourselves truly on the threshold of actual space travel. We see that technologically we have the potential to travel from the earth to the Moon or the nearby planets. The technology necessary for travel to the more distant planets and beyond our solar system is still in its infancy. How long it will take to realize some of the potential that has been discussed here depends on a number of factors. However, there appears to be little doubt now that sometime within the next five to ten years a manned satellite will be placed in an

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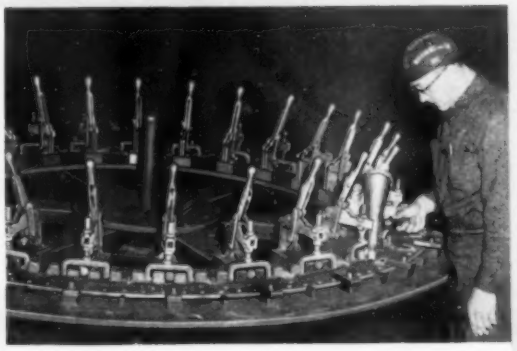

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orbit and that sometime within the next 25 to 40 years interplanetary travel will be accomplished. It has been estimated that by 1962 space flight will be a $2 billion dollar a year business in this country.

In addition to the time necessary for the orderly development of technology and engineering of hardware, there are two very important ingredients. These are money and manpower. Dr. Stuhlinger has estimated that possibly $25 to $50 billion would be required to develop his ionic propulsion ship. This seems an enormous figure, but actually it is only of the order of magnitude of our defense budget for one year, and if spread over 25 to 40 years it is not so bad.

Much has been said and written recently about our shortage of technically trained manpower. The educational program proposed by the President is certainly one step in the right direction, but it is far from adequate. Of one thing we can be sure—if we do not provide this manpower, we will lose much of the ground we have gained in the past 50 years and will have to sit back and watch somebody else reap all the benefits while we become only a second-rate nation.

From a paper presented at the Engineers' Week Program sponsored by the Engineering Society of Detroit, 100 Farnsworth Ave., Detroit, Mich., February, 1958.

▼ ▼ ▼

A Position Readout System for Large Machine Tools: Objectives and Accomplishments

By Arthur O. Fitzner

Research Engineer
Giddings & Lewis Machine Tool Co.
Fond du Lac, Wis.

A perennial problem facing designers of large machine tools for metalworking has been the development of a method for determining the position of the cutting tool relative to the workpiece. Basically, this difficulty is a function of size and, occasionally, the configuration of the machine. It arises because the measuring apparatus must, of necessity, be at considerable distance from the operator's station.

To further improve the performance of such large machines, we became convinced that the solution was to develop

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an entirely new system to permit the machine tool operator to easily determine the position of the tool relative to the workpiece without leaving his control station. If this goal were realized, the operator would thus become an effective element in the positioning control loop, and much time would be saved in positioning the tool from one location to the next.

Development objectives established that the readout system to be developed for this and possibly other applications was to have the following features:

1. Direct reading in the operator's sense of the word.
2. Accuracy of the system should be of the same order as that obtainable with a standard scale and vernier; i.e. ± 0.001 inch over moderate of the distances.
3. Readability of the information displayed by the readout unit should be easy, with no interpretation required, and therefore superior to the scale and vernier.
4. Memory and freedom from drift in the system, which should not lose the position reading upon loss of power, but should recover exactly upon restoration of power. There should be no drift of the reading when the machine is standing still.
5. Acceptable size and shape of the readout unit shou'd be like a meter, suitable for mounting in a pendant station.
6. Flexibility should be possible to be able to employ these systems on any member of machine motions and on many different types of machines.
7. Cost and reliability of the system should lie economically acceptable, less expensive than closed-circuit television, and fully reliable.

The three components that comprise the system that grew from our development work were the readout unit, the input synchro and servoamplifier. The system is in reality an instrument-type servomechanism, when the machine moves, it rotates the shaft on the input synchro and the counters follow.

The four movements of this machine are: (a) headstock up and down—12-foot travel; (b) column backward and forward—18-foot travel; (c) spindle in and out—8-foot travel; and (d) underarm in and out—8-foot travel. Maximum speed on all these motions is 120 ipm.

Specifications of the new readout system:

Range:
+999 inches to −999 inches
Max rated speed:
120 inches per minute
Power input:
115 volts, ± 10 percent; 1.5 amp.; 60 cycle
Zero offset:
Motorized plus hand setting
Accuracy:
(a) ± 0.0005 inches from input synchro to counters; (b) ± 0.0005 inches from machine to input synchro (for small motions of 12 inches or less).
Max acceleration:
Will follow any acceleration from zero speed to 120 ipm without pulling out of synchronism
Velocity coefficient:
70 per sec. (for small error angles)
Torque coefficient:
(a) 0.225 ounce-inches per degree measured at motor shaft; (b) 3 ounce-inches per 0.001 inches reading division measured at countershaft
Size of readout unit:
5¾ inches by 7 11/32 inches by 6¾ inches H-W-D; depth behind panel is 5¾ inches

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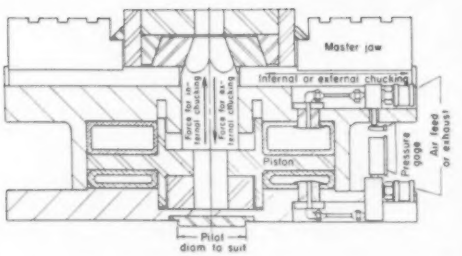
2 Holds Thin Wall Parts without Distortion

SPEEDGRIP "CYL-CHUCK"



Two rubber tubes can be inflated or deflated quickly. Inflating upper tube forces piston downward, moving jaws toward center for external chucking. Inflation of lower tube reverses action for internal chucking. Tubes hold air pressure for several weeks. No connection to air source needed during work cycle. Air gauges determine pressure. Air gun attaches to valves for inflation or deflation. Holding forces up to 100,000 lbs. on 100 P.S.I. supply. Turns entire O.D., or bores entire I.D. on same chucking.

SELF-CENTERING "CYL-CHUCKS"

For second operation chucking on finished or semi-finished surfaces. Wrap-around jaws hold part concentric within .001" for boring or turning.

COMPENSATING "CYL-CHUCKS"

For first operation work. Intermediate jaws and hardened inserts produce up to 12 equalized pressure points to hold rough castings and forgings while boring or turning.

Write for Bulletin No. 23 for full description and technical details.

SPEEDGRIP CHUCK

Division of ERNEST, HOLDEMAN & COLLET, INC.
Elkhart, Indiana

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-230

Size of amplifier unit: 11¼ inches by 19 inches by 8⅜ inches H-W-D; depth behind panel is 3 inches

Based on a paper presented at the 22nd Annual Machine Tool Electrification Forum at Buffalo, N. Y., sponsored by the Westinghouse Electric Corp., Pittsburgh, Pa.

▼ ▼ ▼

Aluminum Engines-Design for Modern Fabrication

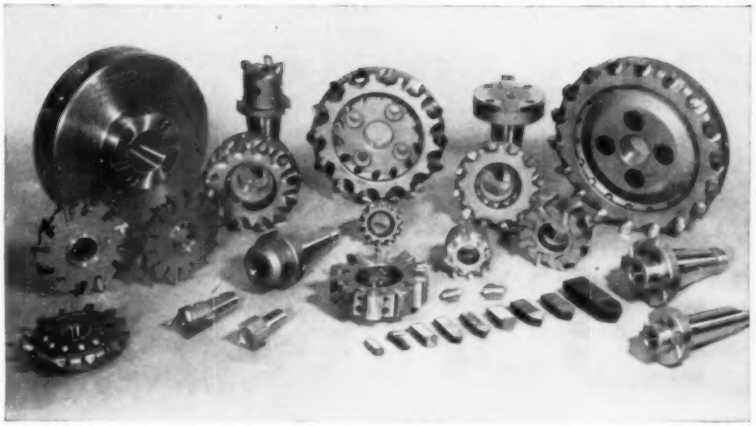
By James M. Smith
and
Richard M. Smith
Aluminum Co. of America
Pittsburgh, Pa.

Experience with the all-aluminum automotive engine has demonstrated the many advantages it has over the now conventional ferrous unit. A partial list would include:

1. Reduction in engine weight assists in solving critical vehicle weight distribution problems. Lighter engine supporting members enhance the over-all weight reduction with resulting improvement in vehicle performance and economy. Reduction in weight contributes to the solution of the serious braking problem, and also makes possible the use of smaller, therefore cheaper, tires.
2. Production cost savings and reduction in capital investment realized by employing the higher machining speeds and feeds, lower finish allowances and ease of handling are possible with aluminum.
3. High thermal conductivity affords excellent paths for dissipation of heat. Volumetric efficiency and specific engine performance are improved. Moderate temperature gradients and elimination of local hot spots in thermally loaded parts reduce thermal strains and distortion.

When designing with aluminum, certain design details have been found particularly important. These would include: (1) blending at severe section changes, (2) marginal distance at bolt holes, (3) bolt boss diameters and threaded depth of holes, (4) broad, flat, low ribs in general, as contrasted to narrow, round and high (these are frequent causes of failure, and (5) bolt fastenings located in, or near supporting wall sections to minimize accentric loading, inducing bending.

Based on a paper presented at the SAE Summer Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J., Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N. Y.



Milling Cutters — End Mills — Blades — Boring Tools — Arbors — Flywheels

These Lovejoy Products can help you Cut Costs!

The entire line of Lovejoy Milling Cutters and Accessories is designed to aid you in getting better production at less cost.

If you are not now using Lovejoy products, we invite you to do so at first opportunity.

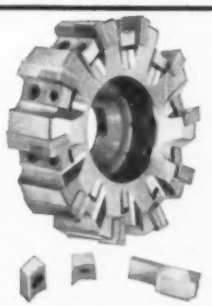
Lovejoy precision-engineered tools include:

Inserted-tooth milling cutters (face, side, end, slotting and boring) which feature husky, forged steel housings; exclusive Lovejoy "positive-locking" blade assembly; a variety of dozens of models and hundreds of sizes.

Blades: H.S.S., Vasco Supreme and carbide. These are interchangeable over a wide range of housing sizes, and Type "A" face milling blades will fit any standard Lovejoy Type "A" cutter of 4½" to 24" dia. All Lovejoy blades are carried in stock, ready for immediate shipment. Special cutters are a Lovejoy specialty.

NEW "JOYDEX"

This performance-proved face mill features indexable blades for low cost-per-edge cutting. Exclusive design improvements include — adjustable anvils • extra deep chip flutes • fast, easy indexing • sweep blades for fine finish • double positive, or combination positive and negative rake angles merely by changing blades • rugged, one-piece body • large locking screws. *Try out a new "Joydex" and prove its superiority! ("Joydex" data sheet is yours for the asking).*



Catalogs — include: "Face Mill Catalog No. 31; Side Mill Catalog No. 32; Type "S" Bulletin; Arbor Catalog No. 33; "Speed and Feed" Calculator. Write today for copies desired.

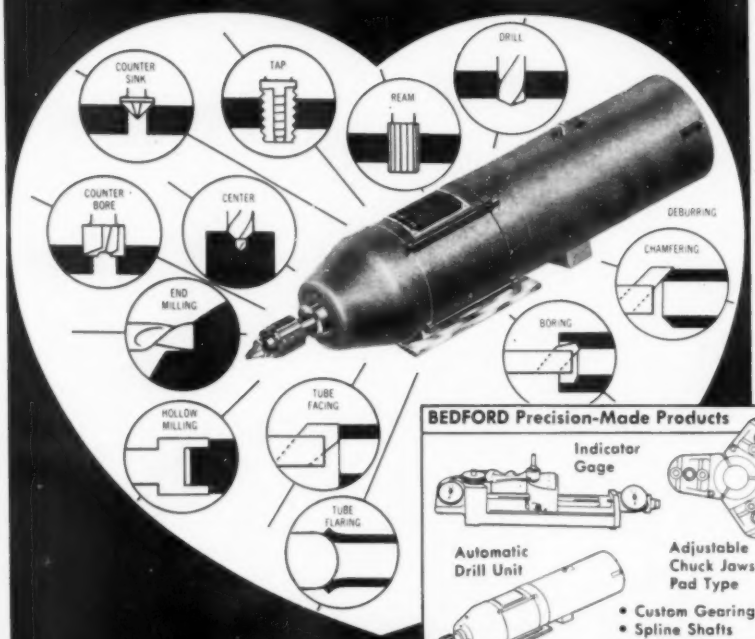
LOVEJOY TOOL COMPANY, INC.
Springfield, Vermont, U. S. A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-231

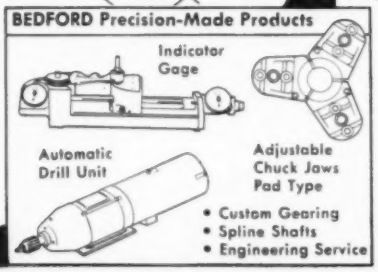
The "HEART" of Automation . . .

Bedford Gear's

HYDROSCAPE AUTOMATIC DRILLING UNIT



BEDFORD Precision-Made Products



- Custom Gearing
- Spline Shafts
- Engineering Service

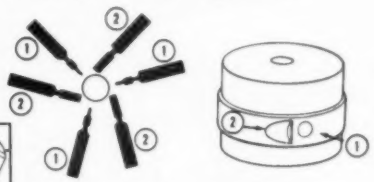
More Automatic Operations Per Dollar!

PROVEN:

10% REDUCTION in cycle time by the addition of ONE BEDFORD Hydroscape Automatic Drilling Unit to the production line.

PROVEN:

6½ MINUTES LESS than the next best alternate machining method.



WRITE FOR FREE CATALOG AND DATA SHEETS.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-232-1

MAYLINE

YOU CAN'T BUY BETTER!

Productwise, pricewise, combinationwise, you can't beat Mayline products. Serving industry for a long, long time, Mayline has acquired an enviable reputation for fine drafting room furniture and equipment.

Mayline has for its customers the May-O-Matic, 4-Post table in steel and wood, pedestal style tables, metal and wood plan files, drawing boards, and kits, straight-edges and other equipment. Your dealer sells Mayline.

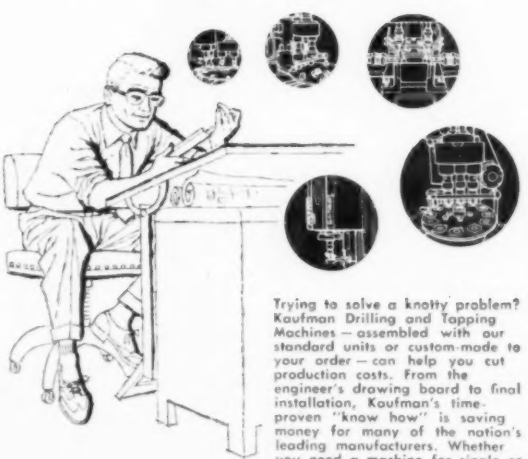
MAYLINE COMPANY
611 No. Commerce St.
Sheboygan, Wisconsin

MAYLINE

USE READER SERVICE CARD; INDICATE A-9-232-2

PRECISION MACHINE TOOLS FOR ANY JOB ARE MADE BETTER BY

KAUFMAN



Trying to solve a knotty problem? Kaufman Drilling and Tapping Machines — assembled with our standard units or custom-made to your order — can help you cut production costs. From the engineer's drawing board to final installation, Kaufman's time-proven "know how" is saving money for many of the nation's leading manufacturers. Whether you need a machine for single or multiple operation or a machine for a new, unusual job — see Kaufman. Write or telephone for full information today!

KAUFMAN

KAUFMAN MFG. CO.
553 S. 29th Street — Manitowoc, Wisconsin

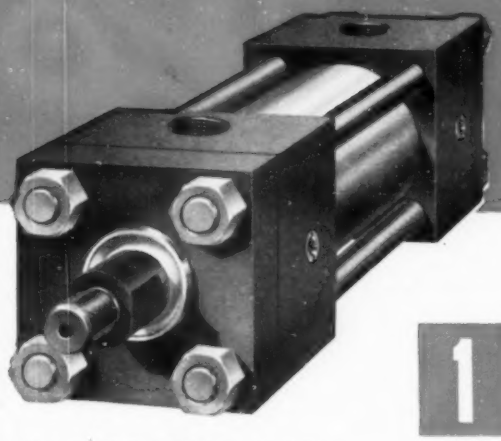
USE READER SERVICE CARD; INDICATE A-9-232-3

SEAL FAILURE MEANS CYLINDER FAILURE

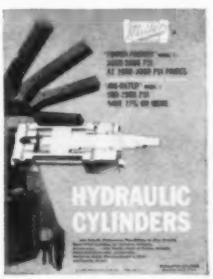
Petroleum base, fire-resistant and special hydraulic fluids cause distortion and rapid deterioration of the seals currently used in many hydraulic cylinders, resulting in costly repairs and cylinder failure. (Seals made of synthetic rubber are not compatible with even 50% of available commercial petroleum base fluids and the life of such seals is materially reduced at operating temperatures above 150° F.)

Specify Miller HYDRAULIC CYLINDERS

FOR UNLIMITED SEAL LIFE!



Request Bulletin JH-104N for complete data plus helpful charts on column strength, cylinder forces, factors of safety, acceleration, pipe pressure losses, etc.



1 ALL TEFLON* SEALED Against External Leakage

TEFLON is impervious to all known hydraulic fluids, including all fire-resistant and special types – and withstands temperatures from −100°F. to plus 450°F.

TEFLON SHEF SEAL AT TUBING ENDS

No blind assembly. Is
Shear-proof
Heat-proof
Extrusion-proof
Fluid-proof

TEFLON SEALS ON PISTON ROD AND BUSHING

Teflon rod flange seal requires no adjustment. Teflon bushing seal is shearproof. Teflon wiper keeps dirt out.

TEFLON SEALS ON BALL CHECK AND ADJUSTING SCREW

Non-protruding, self-locking, cushion adjusting screw interchangeable with ball check for easy access.

2 CASE-HARDENED CHROME PLATED PISTON RODS

Provide foolproof protection against seal failures resulting from rod damage. The Miller case-hardened rods (50-54 Rockwell C) give practically complete immunity to damage from hammer blows, wrench-dropping, mishandling, etc. The hard chrome plating over the case-hardened rods protects against scratch-damage and rust.

AVAILABLE IN TWO TOP QUALITY LINES

JOB-RATED
Model "J"

PRICE SAVINGS OF 27% OR MORE!

19 mounting styles, all strokes, cushioned and non-cushioned. Large selection for immediate shipment.

BORE	SEVERE OPERATING CONDITIONS	MODERATE OPERATING CONDITIONS	YOU SAVE THIS % IN PRICE OVER STANDARD 2000-3000 PSI CYLINDERS
1½"	1500 PSI	2500 PSI	27%
2	1500	2500	27%
2½	1000	1500	28%
3¼	1500	2500	32%
4	1000	1500	35%
5	800	1200	37%
6	800	1200	43%
8	500	800	50%
10	500	800	71%
12	500	800	76%
14	500	800	*Not Available in 2000-3000 PSI*

POWER-PACKED
Model "H"

50% More Power Per Cylinder Dollar!

For
3,000-5,000 P.S.I.

1½" through 12" bores, 17 mounting styles, strokes up to 22 ft., cushioned and non-cushioned. Large selection for immediate delivery.

*DuPont trademark for its tetrafluoroethyline resin

OTHER MILLER QUALITY FEATURES

- Solid Steel Heads, Caps and Mountings.
- Precision-Honed Barrels.
- Rust-Resistant Coating on All Non-Wearing Surfaces.
- Space-Saving "Square" Design.

MILLER FLUID POWER
DIVISION OF FLICK-REEDY CORPORATION

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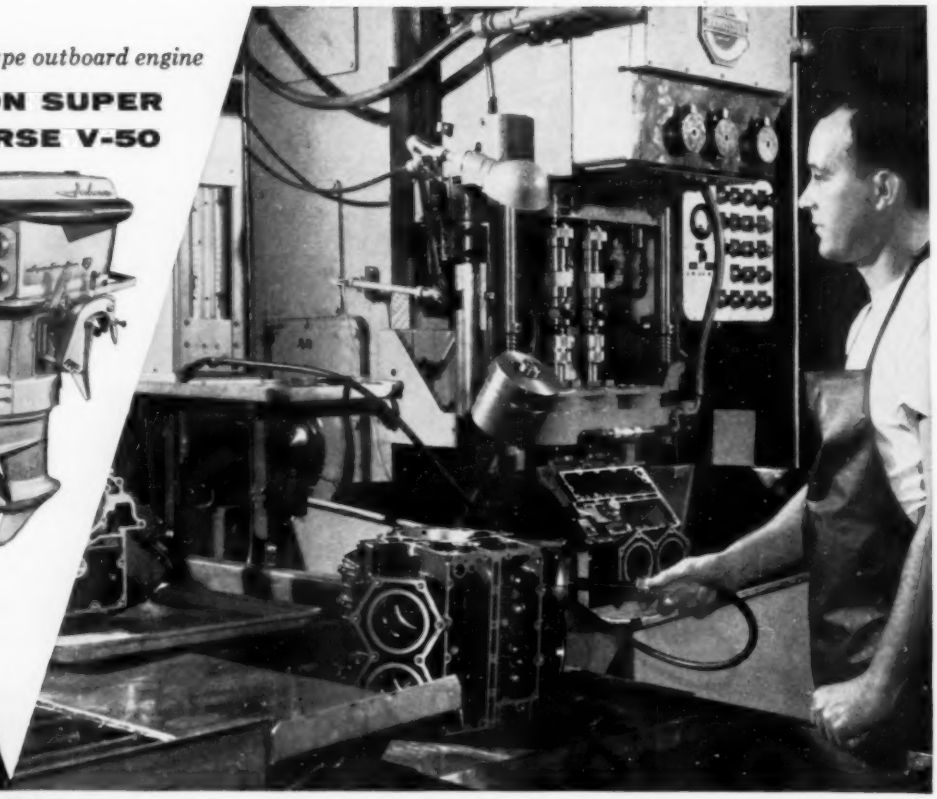
AIR AND HYDRAULIC CYLINDERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS • BOOSTERS

world's first V-type outboard engine

JOHNSON SUPER SEA HORSE V-50



Honed on new BARNESDRIL Honing Machine!

1.7 minutes cycle time per block, honing 4-cylinders—each with 8 ports — ±.00025" bore-to-bore size, ±.0001" roundness and taper, 38-45 RMS finish.

This BarnesdriL Honing Machine, located in the Waukegan plant of Johnson Motors, is arranged for conveyor-line production and automatically sizes and finishes cylinder bores of two different V-engine aluminum blocks with integral cast-iron sleeves. Operator has convenient pushbutton control of the machine and trunnion-type fixturing for production line efficiency. The machine accomodates the two different blocks through 3-spindle head and hydraulic lateral index to locate proper offset between the cylinder banks.

Cycle time of 1.7 minutes includes Plugmatic bore-to-bore sizing and dwell for positive depth blind-end honing. Size, straightness and roundness over 8 ports in each bore are consistently controlled by BarnesdriL electronic hone expansion, plugmatic bore-to-bore sizing, and automatic compensation for stone wear.

If you have high-quality-bore production problems, consult BarnesdriL engineers for production line and quality control. Estimates furnished with no obligation. Send part samples or drawings.

BARNES DRILL CO.

870 CHESTNUT STREET • ROCKFORD, ILLINOIS

DETROIT OFFICE: 13121 Puritan Avenue

ANOTHER CUSHMAN AIR CHUCK AT WORK!

Hold it right and machine it faster with:
CUSHMAN air operated chucks
rotating air cylinders
manually operated chucks
power wrench chucks and power wrenches
pinch jaw chucks—hand and automatically operated
boring mill and face plate jaws

CUSHMAN CHUCKS,
a product of American quality,
labor and materials.

Sold through
your industrial
distributor.

THE CUSHMAN CHUCK COMPANY

hartford 2, conn.

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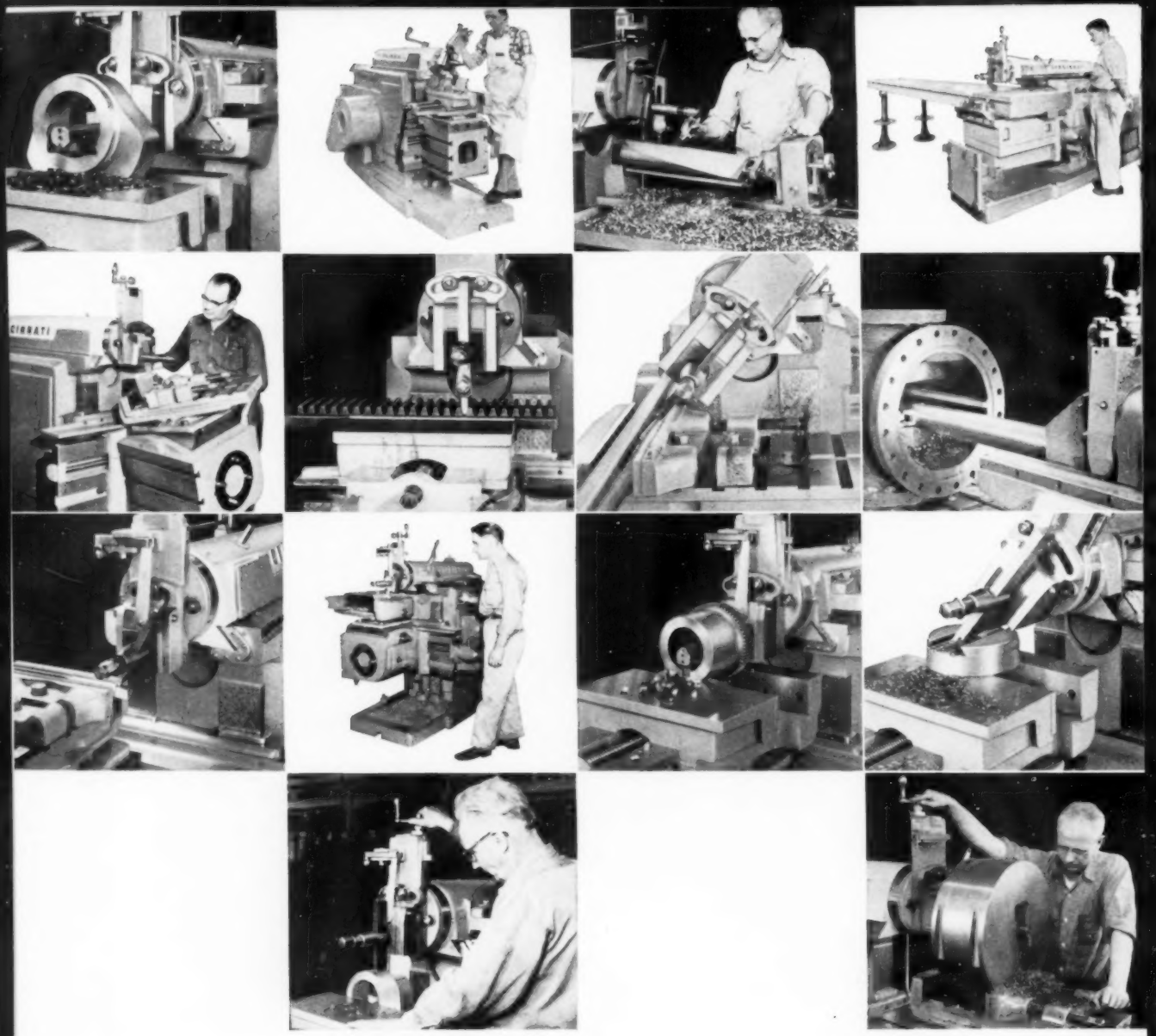
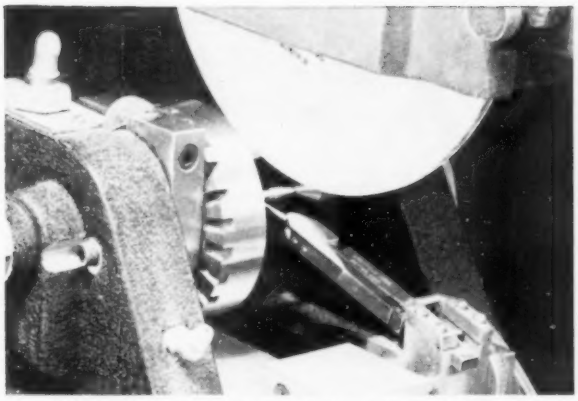


PAYOFF: VERSATILITY

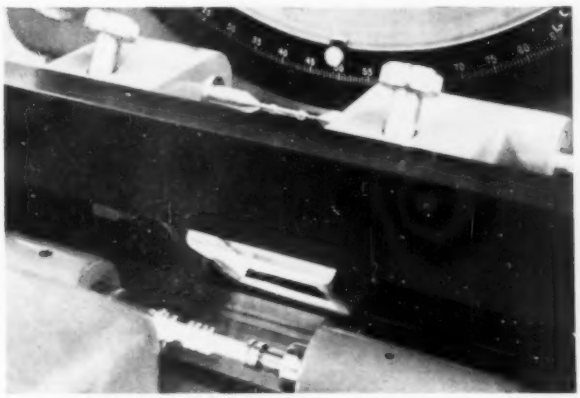
In the tool shop or in your high production bay, the wide-ranging versatility of a Cincinnati Rigid Shaper gives you maximum productivity for your invested dollar. And for each of the many jobs you can do on it, a Cincinnati Rigid Shaper produces something extra – in metal cut per hour, in accuracy, in ease of operation. See for yourself why a new Cincinnati Shaper would pay off for you: write Dept. E, for Catalog N-7, just off the press.

Shapers / Shears / Press Brakes

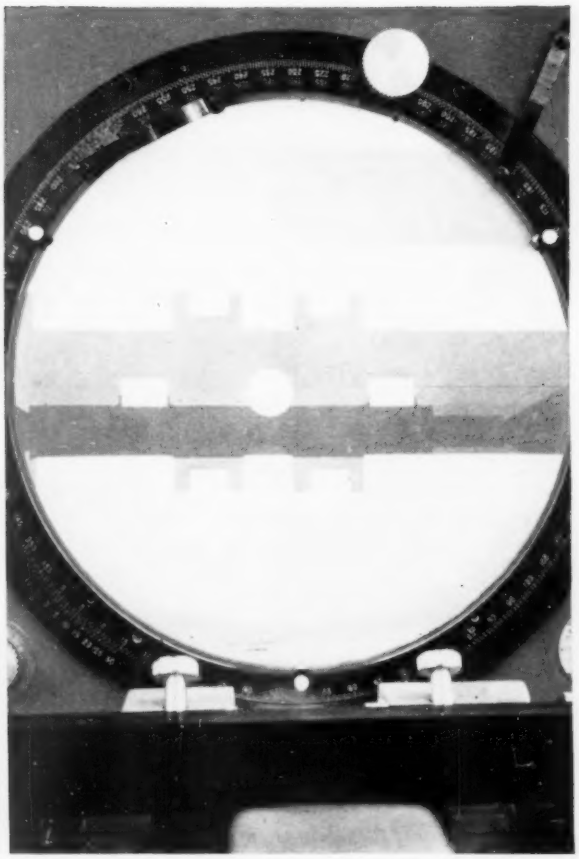
THE CINCINNATI SHAPER CO. Cincinnati 11, Ohio, U.S.A.



1. Piston lands on hydraulic control valves are trimmed on a surface grinder fitted with motorized centers.



2. After trimming, piston and sleeve are mounted on worktable of Kodak Contour Projector for simultaneous projection by two light sources to gage amount of stock removal.



3. Overlap of piston and sleeve images is indicated by black area; overlap can be measured quickly by traverse of one part and observation of dial indicator.

How to do a 7½-hour gaging job in half an hour

How would you solve a gaging problem like this one?

In developing hydraulic control valves, engineers at a major firm producing aircraft components worked out a neat method of trimming piston lands in relation to ports in their mating sleeves.

But meeting the required .0002″ overlap between piston lands and sleeve ports meant using several different gages to determine the amount of stock which had to be trimmed. Result: *7½ hours to trim each valve.*

To solve the problem, quality control engineers now use a Kodak Contour Projector with two light sources and two filters, one red and one green. This system projects a superimposed image of the piston on the sleeve. Where an overlap occurs, the red and green images combine into a black image. The width of this black overlap gives the amount of trim required. Result: *just ½ hour needed—7 hours saved on each valve!*

Maybe you've come up against a gaging problem that's eating up time and money in large quantities. To learn how you can solve it by optical gaging, send for the booklet "Kodak Contour Projectors." Write to:

Apparatus and Optical Division

EASTMAN KODAK COMPANY, Rochester 4, N. Y.

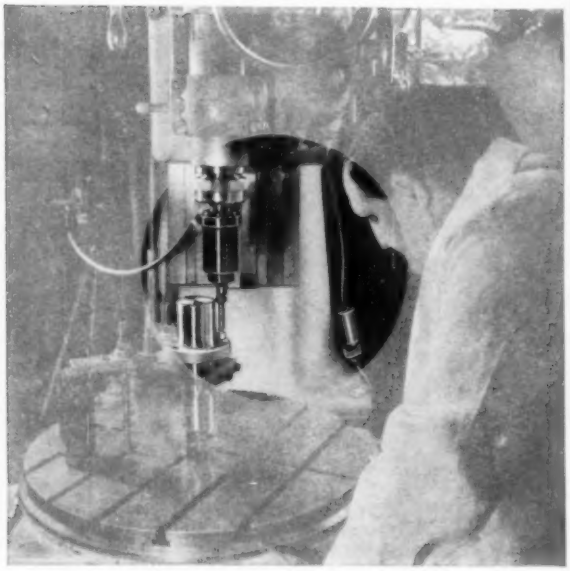
the KODAK CONTOUR PROJECTOR

Kodak
TRADEMARK

H○LES

JIG GROUND with

Vulcanaire



SPECIAL DEEP HOLE JIG GRINDING

The flange required jig ground holes. Using a special grinding arbor attached to a 20.000 Series Vulcanaire on a standard jig borer, tolerances in tenths of thousandths were held. A tough grinding job made easy.

Provide yourself with this inexpensive instrument for use on your present equipment and JIG GRIND with a guarantee.

{ Borrow our instructive 11 minute movie on Jig Grinding. }

SERVICES OF YOUR TOOL ROOM IN DAYTON
ENGINEERING • PROCESSING • BUILDING • TOOLS
DIES • SPECIAL MACHINES • VULCANAIRE JIG
GRINDERS • MOTORIZED ROTARY TABLES • BREHM
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VULCAN TOOL COMPANY
751 Lorain Ave., Dayton 10, Ohio

VULCAN tools

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- LATCH BOLTS
- CAST IRON HAND KNOBS
- ALUMINUM HAND KNOBS
- QUARTER TURN SCREWS
- SHOULDER SCREWS
- JIG FEET (3 TYPES)
- SPHERICAL WASHERS
- FIXTURE KEYS
- KNURLED HEAD SCREWS
- TOGGLE SHOE CLAMPS & V-PADS

HOLD DOWN AND CLAMPING TOOLS
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CATALOG INCLUDES TRACING TEMPLATES

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ACCURACY .0002 T.I.R.

.0002 T.I.R. or less at Spindle Nose, .0005 T.I.R. or less on Test Arbor six inches from Spindle Nose

SPINDLE SPEEDS 150 and 250 RPM Other Spindle Speed Pulleys Available

MODEL B943 MOTOR DRIVEN WORK HEAD

No. 11 B & S Tapered Spindle Standard Equipment. No. 12 B & S or No. 5 Morse Available at Slight Extra Cost.

Clip ad to your letterhead and send for Literature

K. O. Lee Company, Aberdeen, S. D.

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HARD GEAR HONING

CURRENT RESULTS

The following records are taken from current gear honing operations to show how some of the troublesome hazards of gear manufacturing are overcome by honing.

WHAT HONING ACCOMPLISHED

GEAR "A"

A lead error of .0008" was reduced to .0001"

GEAR "B"

Runout was improved .0020"

GEAR "C"

Notable improvement in both surface finish and in amount of tooth kickout

GEAR "D"

Variation in involute form improved .0002"

GEAR "E"

Size over pins reduced .004" and all nicks removed. Essentially a salvage job

THESE ARE THE GEARS BEING HONED

Gear	No. Teeth	Pitch Dia.	Rockwell "C"	Stock Removed	TIME	
					Honing	Floor to Floor
"A" INTERNAL	83	5.7832	58-63	.0015	40 sec.	70 sec.
"B" PLANET PINION	15	.790	56	.0005	27 sec.	31 sec.
"C" REAR SUN GEAR	45	2.3726	54	.0006	30 sec.	34 sec.
"D" REAR SUN GEAR	45	2.508	58	.001	24 sec.	30 sec.
"E" SPUR GEAR	46	6.000	60	.004		3 min. 25 sec.

NOTE: Hone Life, Gear "B"—6000 to 8500 pieces
Gear "C"—3000 to 4000 pieces

Write for Bulletin H-57-2

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING, GEAR HONING AND ELLIPTOID

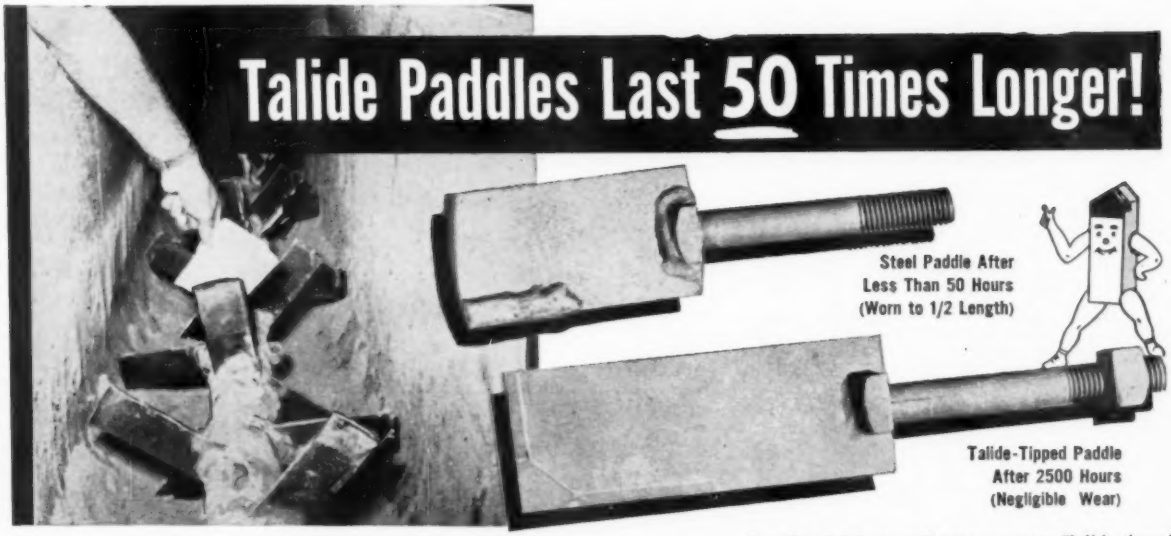
NATIONAL BROACH & MACHINE CO.

5600 ST. JEAN • DETROIT 13, MICHIGAN

8098

WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT

Talide Paddles Last 50 Times Longer!



HARDEST MAN-MADE METAL!

TALIDE METAL, a tungsten carbide of superior quality, is harder, stronger, and more resistant to abrasion than any other metal. Properly applied, it gives superior service on applications where wear, heat, strain, and shock are destructive to other metals.

- **ABRASION RESISTANCE**— Up to 100 times that of steel.
- **COMPRESSIVE STRENGTH**— Higher than all melted, cast or forged metals and alloys.
- **RESISTANCE TO DEFORMATION**— 2 to 3 times greater than steel.
- **HEAT RESISTANCE**— Resists oxidation and thermal shock up to 1500° F.
- **THERMAL EXPANSION**— Less than half the rate of steel, "creep" is negligible.
- **FRICTIONAL RESISTANCE**— Lower than steel, non-galling, "slippery" properties higher.

ALL TALIDE METAL grades are made in latest type vacuum electric furnaces by precision methods under rigid control. A wide variety of shapes and sizes can be supplied—up to 25" in diameter, 100" in length, and 5000 pounds by weight. Parts can be supplied to any grit finish required down to one micro-inch. The physical properties of the most commonly used grades are listed below. Other grades are available for specialized applications.

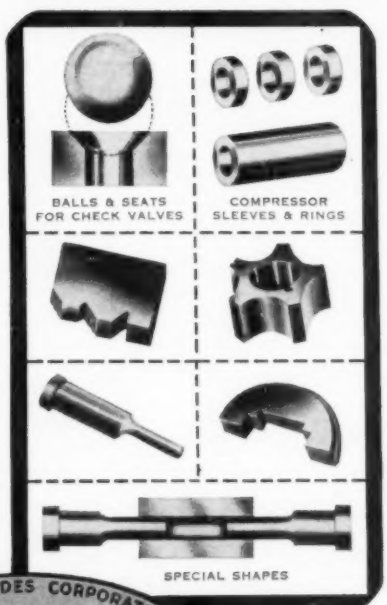
PHYSICAL PROPERTIES OF TALIDE METAL (P. S. I.)

Application	Operation	Talide Grade	Rockwell "A" Hardness	Specific Gravity (Density)	Transverse Rupture Strength	Compressive Strength	Co-Efficient of Thermal Expansion	Modulus of Elasticity (Deflection)
WEAR SURFACE	No Shock	C-91	91.8	14.90	235,000	710,000	3.00x10-6	91,000,000
	Light Shock	C-99	91.0	14.75	265,000	670,000	3.65x10-6	84,000,000
	Medium Shock	C-88	89.5	14.55	295,000	635,000	4.00x10-6	80,000,000
IMPACT	Light	C-85	88.4	14.25	315,000	600,000	3.75x10-6	77,000,000
	Medium	C-80	87.0	13.85	335,000	550,000	4.50x10-6	74,000,000
	Heavy	C-75	85.0	13.15	355,000	500,000	5.00x10-6	70,000,000

Note: Hardness values may vary plus or minus .2 to .3 on individual lots.

Leading brick manufacturer reports Talide-tipped pug mill paddles have outlasted 50 sets of hard-faced steel paddles to date—and are still in use. Operation involves mixing abrasive ceramic, clay and brick compositions.

TALIDE METAL is saving industry millions of dollars annually by wear-proofing vital parts on machine tools, presses, pumps, compressors and other types of processing equipment used in the steel, oil, chemical, plastic, auto, rubber, textile, glass, ceramic, mining and metalworking industry.

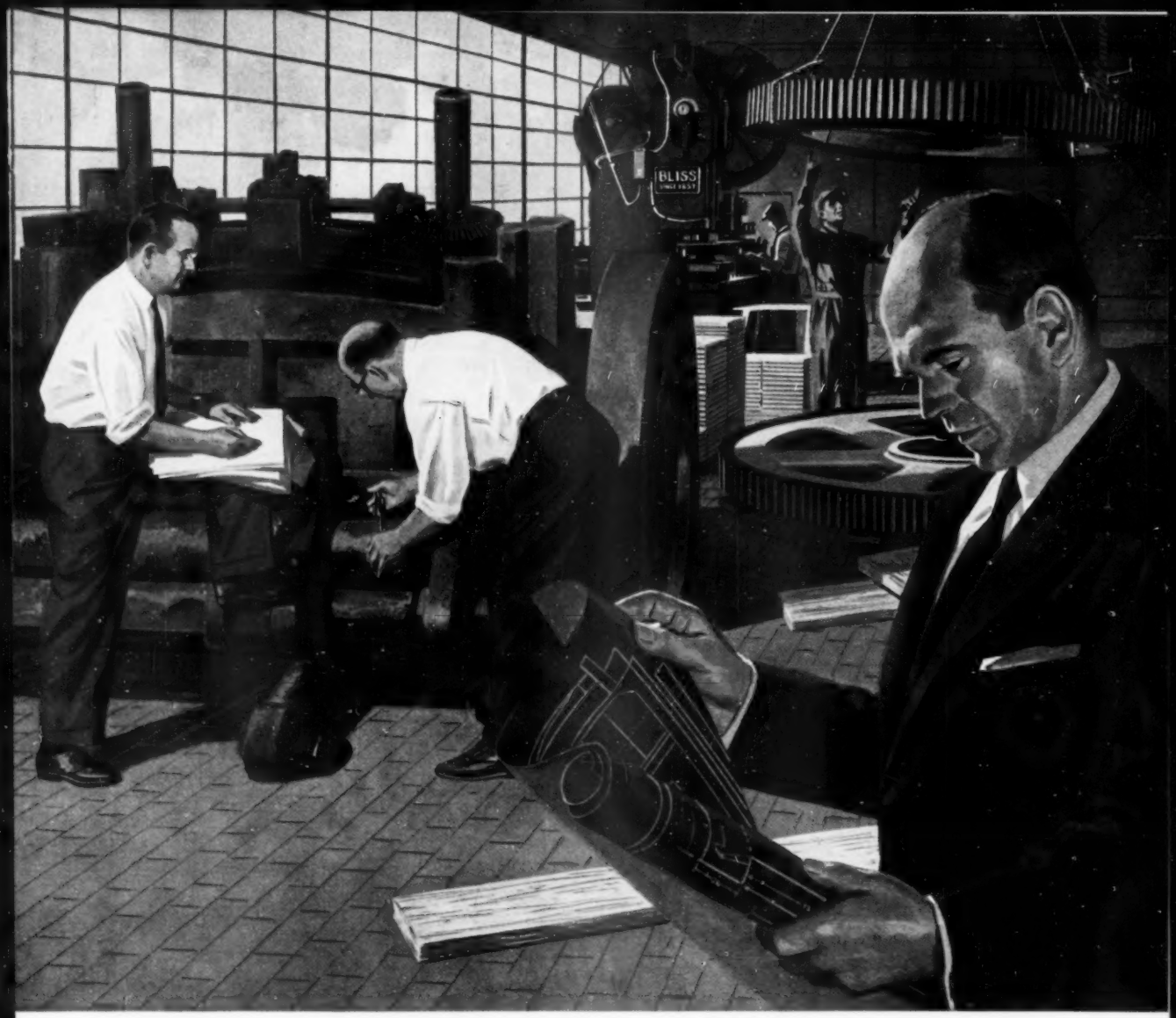


Send for new 76-page catalog 56-G or ask for sales engineer to call.

Metal Carbides Corporation
Youngstown 12, Ohio

METAL CARBIDES CORPORATION
MC
TALIDE®
YOUNGSTOWN 12, OHIO

HOT PRESSED AND SINTERED CARBIDES • VACUUM METALS
HEAVY METAL • ALUMINUM OXIDE • HI-TEMP. ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY



How to breathe new life into your old presses . . .

Modernize! Replace the old, outdated features on your presses with brand new factory-engineered assemblies. New clutches, new slide adjustments, new bearings—these are only three of the 42 Bliss modernization assemblies you can add right in your own plant, keeping downtime and outside costs to a minimum. You can add important new press features to your old press at a fraction of the cost of a new press!

When modernizing won't do the job . . . consider *rebuilding*. We've rebuilt presses 20 years old and older—*restored them to their original efficiency!* We replace and refit all wearing surfaces . . . replace worn and outdated parts . . . put your press back together to its original tolerances. And we *guarantee* it.

Which is better—to rebuild or modernize? It depends upon the press and what you want it to do. Your local Bliss man will be glad to give you the facts.

BLISS
SINCE 1857

E. W. BLISS COMPANY · Canton, Ohio

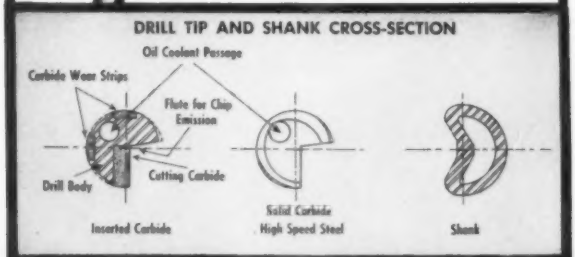
BLISS is more than a name . . . it's a guarantee

PRESSES • ROLLING MILLS • ROLLS • DIE SETS • CAN MACHINERY • CONTRACT MFG.

THIS DRILL ELIMINATES SECONDARY OPERATIONS

Just *one* pass with these high-speed steel or carbide-tipped gun drills produces an accurate, truly round, straight hole honed to mirror-bright finish. That's why you can drill small parts of all kinds — *faster, more accurately* and at *lower cost* with HI-STANDARD Gun Drills*.

Production parts that once had to be drilled individually can now be gang-nested and drilled through, producing holes identical in size, location and finish. Drilling of this kind is done on automatic indexing machines, lathes, horizontal and upright drilling machines, and similar equipment. Forced oil feed through the drill clears chips and cools cutting edge for faster drilling. No matter what the size or shape of your workpiece, drilling with HI-STANDARD Gun Drills is an



outstanding time-and-money saver. Any material that can be *machined*, can be *gun-drilled*.

Gun drilling is one important way in which forward-thinking manufacturers are increasing production and cutting costs. To find out how your company can do the same, write for your Hi-Standard Engineering File 20 *today!*

*Also called "deep-hole drills"

Pioneers in the Design and Development of Gun Drills for more than 30 Years

THE **HIGH STANDARD**
MANUFACTURING CORP.
HAMDEN • CONNECTICUT

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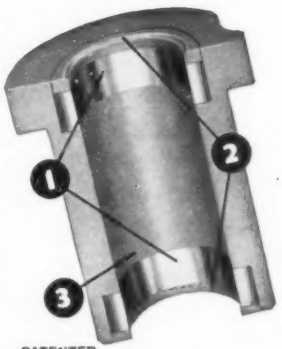
MEYCO CARBIDE INSERTED DRILL JIG BUSHINGS PROVE THEMSELVES *IN Automation!*

The reason is simple: these unique bushings are ideally suited for long-running, uninterrupted operations!

MEYCO carbide inserted bushings assure long life for drills, jigs, fixtures . . . accurate work maintained, resulting in less down-time, fewer lost man-hours. Last almost as long as solid carbide bushings, cost slightly more than ordinary bushings. Get the full story:

Write for information and price list, ask for Catalog No. 42



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1. Tungsten carbide rings at the points of wear; 2. Steel rings protect drills and carbide; 3. Special hardened alloy steel body.

EST. 1888

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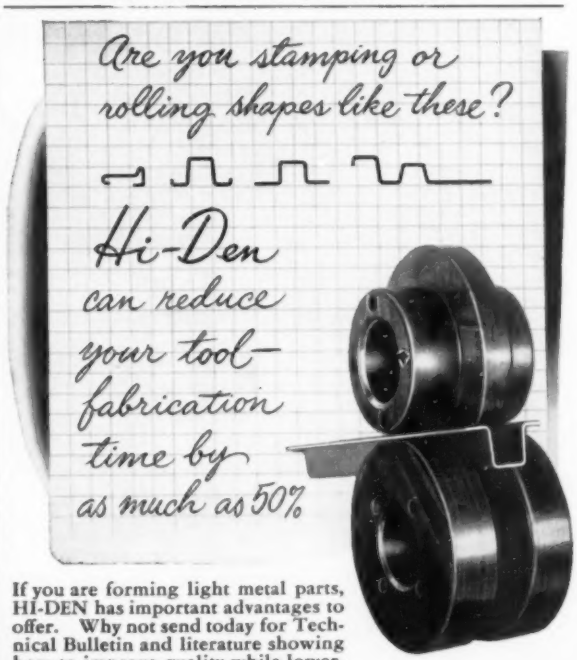


If you are forming light metal parts, HI-DEN has important advantages to offer. Why not send today for Technical Bulletin and literature showing how to improve quality while lowering costs?

Parkwood Laminates, INC.
31 Water St., Wakefield, Massachusetts

USE READER SERVICE CARD; INDICATE A-9-242-3

You can CUT YOUR COSTS with these new and improved CLEVELAND TOOLS

The Cleveland Twist Drill Co., with its more than 80 years of experience and "know how", is constantly working on new developments and improvements to keep pace with modern metalworking techniques. Every tool, designed and manufactured to the same high standards which have made the familiar ◈ trademark famous, will give you *more production per dollar*. For complete information, contact our nearest Stockroom or . . .

TELEPHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR

MO-MAX T-Shaped Ground Cut-off Blades

These improved blades are available in MO-MAX or MO-MAX COBALT High Speed Steels, heat treated to produce *more cuts per grind*. Head and body are ground to close tolerances, resulting in accurate uniformity and reduced set-up time.

Split Sleeves for Straight Shank Drills

The hole in these high quality sleeves is concentric with the body, assuring less run-out at the drill point, longer tool life and better holes. Used with tanged straight shank drills, you get *more flute length at lower cost.*

MO-MAX Hardened and Ground Drill Blanks

New Drill Blanks — hardened all over, and ground without back taper. Wire gauge, letter and fraction sizes, No. 80 to ½ inch, singly or in sets. Useful for making punches, tool bits, countersinks, boring tools, burring tools, etc.

Carbide Die Drills for Hard Steel

For drilling hardened steel in the range of 48 to 65 Rockwell C. Holes may be drilled without annealing or appreciably changing the structure of the material. Can be used with or without coolant.

END MILLS

Hy-Spiral Two Flute Double-end

Proper rake angles and cutting edge relief assure efficient milling in non-ferrous materials and in the harder alloys. Positive chip ejection . . . no build-up on the cutting face. Especially economical on long runs.

Heavy Duty with Duo-Drive Shanks

The 2 inch DUO-DRIVE shank fits the conventional two-set-screw-drive holder as well as the bayonet-lock type of holder. Heavy web construction, accurate machine-ground end-tooth notching and special surface treatment.

Two Flute Extra Long Ball-nose

They have the extra length for milling fillets and pockets which cannot ordinarily be reached by the conventional length end mills. With these center cutting end mills, the initial hole may be "drilled".

Two Flute Double-end Ball-nose

Machine-ground notch and ball end assure the easy removal of chips in deep slotting and pocketing operations, with the resultant savings realized in more material milled per grind. Economical on production runs.

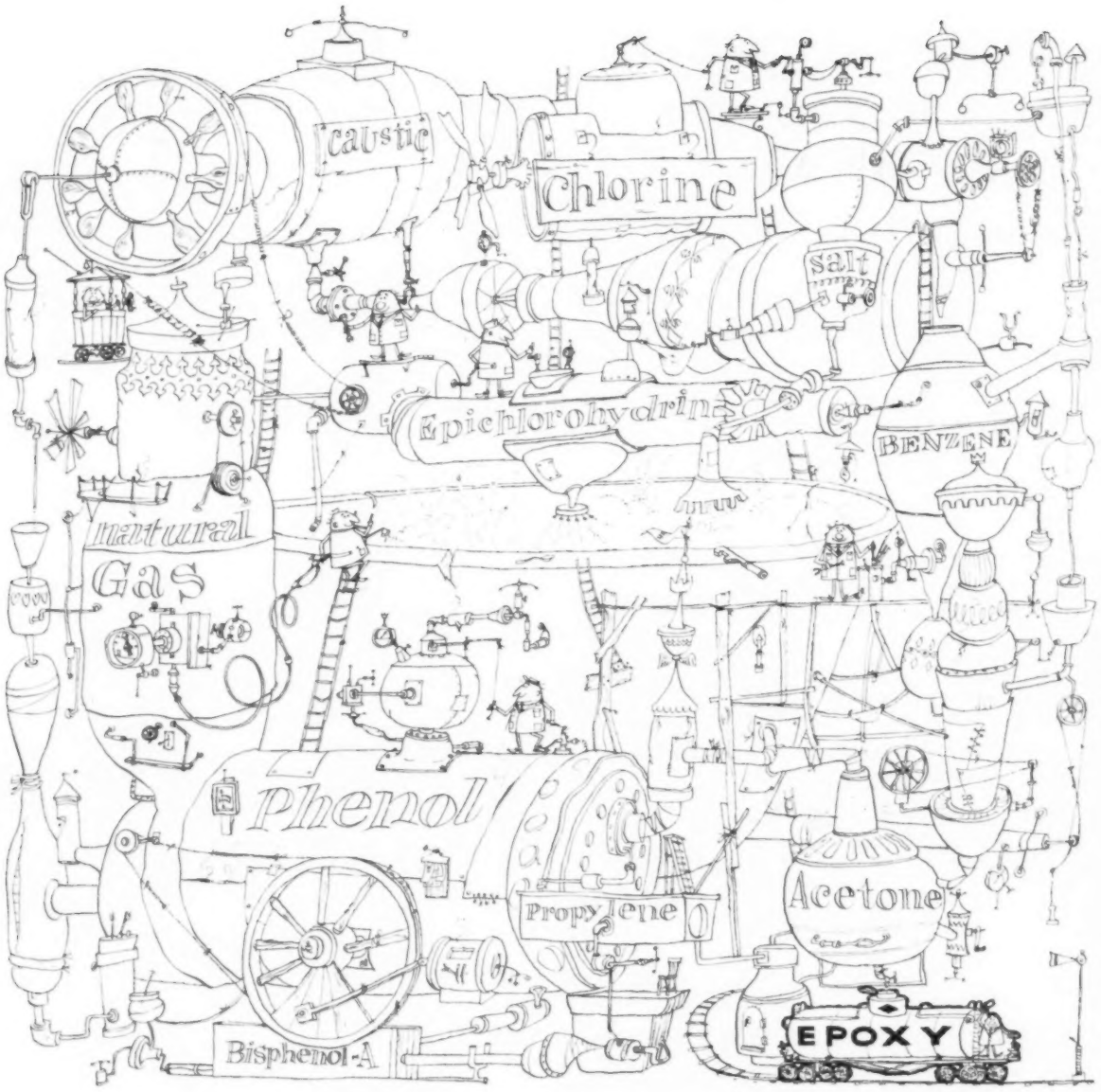
500 SERIES Four Flute Center-cutting

Now you can get the plunge cutting ability of a two or three flute end mill with the finer finishes and better size control that are possible with a four flute end mill. Made with square nose or ball nose.

THE CLEVELAND TWIST DRILL CO.

1242 East 49th Street • Cleveland 14, Ohio

Stockrooms: New York 7 • Detroit 2 • Chicago 6 • Dallas 2 • San Francisco 5 • Los Angeles 58



Dow's basic position in epoxy production assures purity, narrower "spec" range

New Dow Epoxy Resins provide outstanding purity because no other company makes so many (more than 93%) of the raw materials that go into them. And the one sure way to control purity of epoxy resins is to make the raw materials in your own plant, under your own supervision.

Purity is only one benefit enjoyed by users of Dow epoxies. Others are: better quality control, narrower range of specifications, an assured source of supply, and versatility of raw materials. The exclusive control of ingredients has resulted in new and improved epoxies such as D.E.R. 332 (new water-clear liquid resin) and Dow's new line of water-white solid epoxy resins.

With years of experience in producing epoxy raw materials, Dow can assure you Dow Epoxy Resins will best meet your highest specification standards. For information or copies of this cartoon contact your Dow sales office. Or write: THE DOW CHEMICAL COMPANY, Midland, Michigan, Coatings Sales Department 2260M.

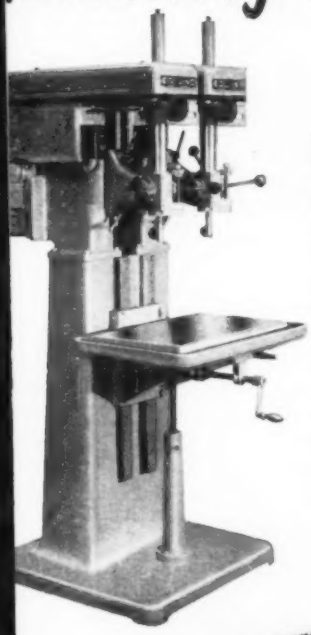
EPOXY T.M.

YOU CAN DEPEND ON DOW ®

EDLUND

"F" SERIES

Infinitely Variable Speeds



Edlund Model 1F

Sensitive machine for small parts and components.

Infinite selection of speeds to 10,000 rpm

7" & 10" Overhang

⅜" Capacity

Pedestal and Bench models

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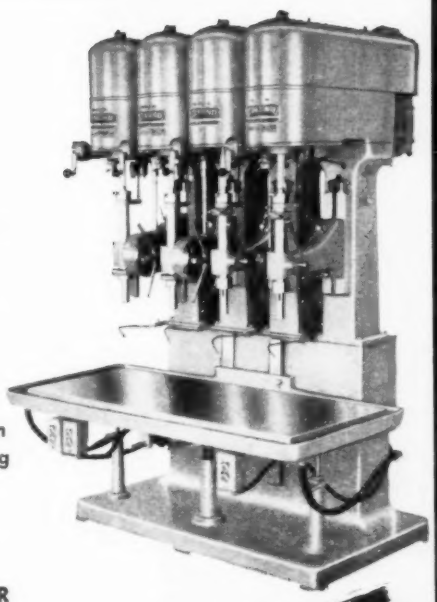


Edlund Model 2F

A top production machine for medium to heavy drilling and tapping.

Infinite selection of speeds to 3,600 rpm
8"–12"–15" Overhang
1¼" Capacity

Pedestal and Round Column types

Write for Bulletin 140R

America's Most Versatile Drilling Machines

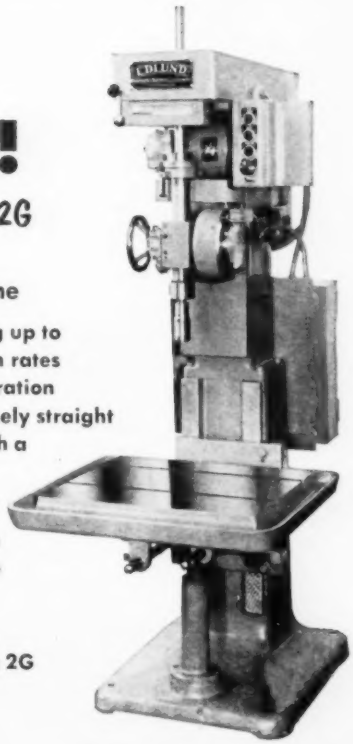
Edlund Model 4F

A work-horse production machine for heavy duty drilling and tapping operations.

1¾" capacity with infinite selection of speeds to 2200 rpm
12" Overhang

Pedestal or Round Column Types

Write for Bulletin 170 R



NEW!

Edlund Model 2G

Vertical Gun Drilling Machine

Deep hole drilling up to 7½" at production rates in one single operation producing extremely straight smooth holes with a finish from 4-8 micro-inches.

⅜" Capacity with spindle speeds to 8000 RPM
12" Overhang

Write for Bulletin 2G

EDLUND REPRESENTATIVES IN MAJOR CITIES

EDLUND MACHINERY CO. Cortland, New York Division of Harsco Corporation

for Taper Shank Convenience with Straight Shank Economy-

Glenzer

Small Tool UTILITY DRIVERS

Use them to speed peacetime production. Ford, General Motors, Chrysler, General Electric, International Harvester, Caterpillar Tractor—thousands of large and small manufacturers and tool shops have been driving drills and other small tools with these sleeves since World War I — for years they've been specified standard.

Utility Tools

This removeable taper shank reduces small tool costs 40% and more, by actual customer records.

THE J. C. GLENZER CO., Inc.
1552 E. NINE MILE ROAD, DETROIT 20, MICH.

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IMMEDIATE DELIVERY ON SOFT BLANK TOP JAWS

SAVE OVER 50%

Soft-Blank Top Jaws are made to American Standards and may be used on any chuck having master jaws that are made to these specifications.

Both Medium and Heavy Duty styles are carried in stock and are available for immediate delivery from 1020 steel.

WRITE TODAY for SPECIFICATIONS and PRICES
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HURON MACHINE PRODUCTS INC
6252 MONROE BLVD. • DEARBORN, MICH.

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GROUND FLAT STOCK

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OVER 2000 SIZES

ALSO
OIL HARDENING (SAE-01)
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For Name of Nearest Dealer Write

MARSHALL STEEL COMPANY
BOX 108, LAGRANGE, ILL.

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USE READER SERVICE CARD; INDICATE A-9-246-3

GUARANTEED

. . . the most precise chuck ever produced

THE NEW Supreme KEYLESS Precisionist®

Made by **Supreme** in **Chicago, U.S.A.,** for the most exacting production line and toolroom use.

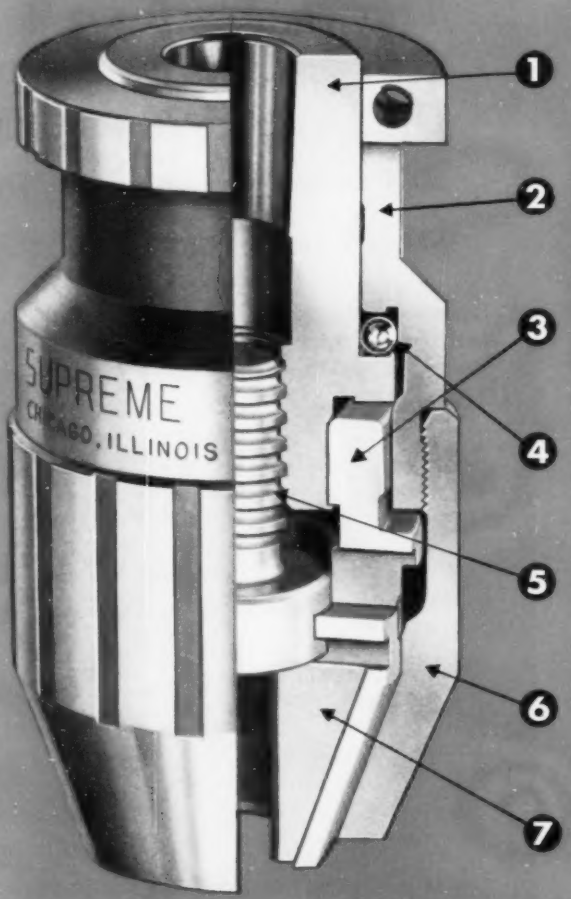
- Exclusive **tool steel jaws**
- Precision-quality **ball** bearings
- Unsurpassed **gripping** power
- Unmatched **accuracy**
- Trouble-free **keyless** action
- Controlled **uniform** materials
- Available now: ½" capacity in Tapers #2, 6, 33 . . . ⅝" capacity in #6 Taper
- Available soon . . . ¼" and ⅜" capacities

1 CHUCK BODY—Ground to extra precision limits. Taper bore air gage checked.

2 GUIDE HOLDER—Internal diameters and shoulder ground in one setting. External shoulders precisely located.

3 JAW GUIDE—Ground to perfect matching fit.

4 THRUST RACE BALL—Hardened chrome steel.



5 SCREW—Carbo-nitrided steel.

6 SLEEVE—Carbo-nitrided steel, extra high surface hardness. Ground to gage makers' tolerances.

7 JAW—Tool steel material, hardened throughout.

Supreme Industrial Distributors stock them to serve you.

Supreme BRAND Chucks

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2222 S. Calumet, Chicago 16
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LOOKING FOR MORE FROM

Trim steelcutting costs with Carboloy® Extra-Performance Grades 330, 350, and 370, and low-cost, General-Purpose Grades 78 and 78B

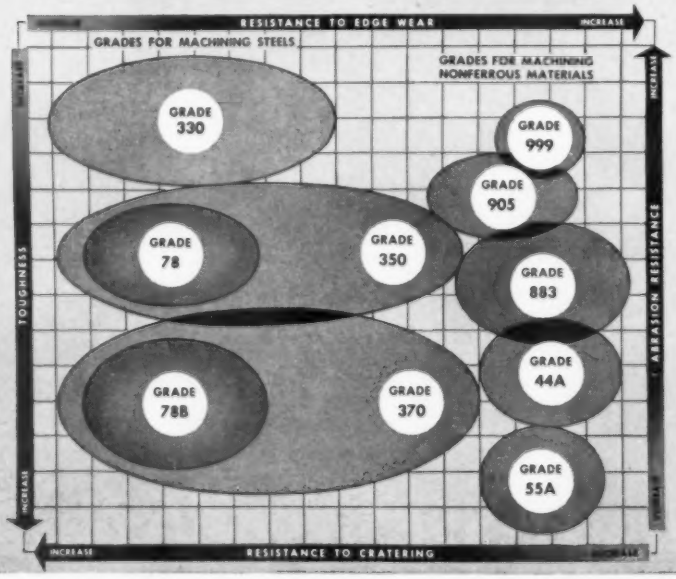
Some steelcutting jobs call for extra-tough, extra-performance carbides. Others can only be handled profitably with low-cost, general-purpose carbides. That's why we make them *both*.

Where you need increased machine productivity and have long production runs, to keep cost-per-piece low use Carboloy Extra-Performance Series 300 carbides. Their added strength and stamina handle jobs ranging from heavy roughing to high-speed finishing . . . at a cost and rate no "premium" carbide on the market can beat.

But, for general-purpose steelcutting jobs that don't require the Extra-Performance carbides, use Carboloy Grades 78 and 78B. Their top-notch performance, at low initial tool cost, will keep your machines operating profitably.

Chances are, your plant should be using *both* grades. Your local Authorized Distributor of Carboloy cemented carbides can deliver tools, blanks and inserts you need . . . in a hurry.

This complete team of Carboloy cemented carbides gives you more for your carbide tool dollar!



YOUR CARBIDE TOOL DOLLAR?

Cut nonferrous materials with low-cost Carboloy® Grades 44A and 883 . . . get longer tool life, increase production rates

These Carboloy cemented carbides are performance-matched to your cutting job for optimum machine productivity.

For interrupted cuts and tough production runs, use Carboloy Grade 44A. High shock resistance and good wear resistance make this a versatile grade for all machining jobs where a rugged carbide is needed.

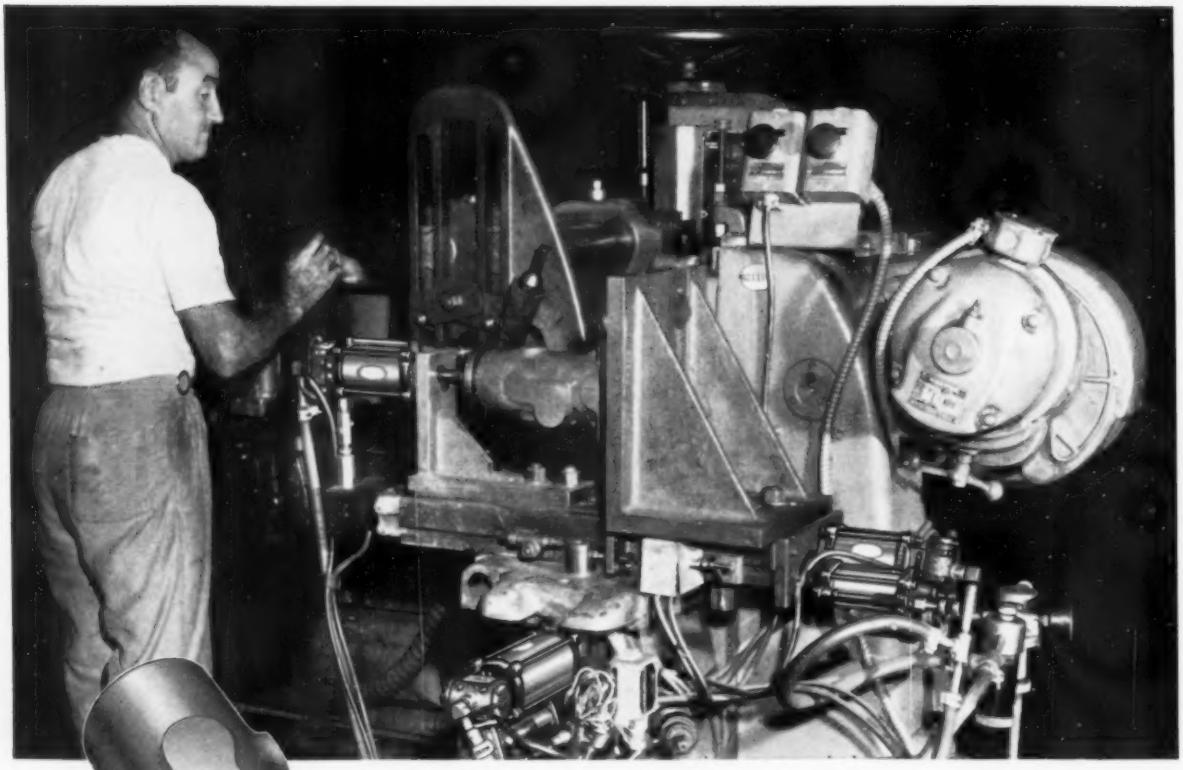
When your job demands a carbide with built-in stamina and high wear resistance for general-purpose machining of nonferrous materials, use Carboloy Grade 883. You will get longer tool life and lowest cost-per-piece.

There are 5 Carboloy cemented carbides for cutting nonferrous materials, including Grades 44A and 883. One of these is designed especially for the particular characteristics of your cutting job to give maximum tool efficiency. Job-matched performance of these Carboloy nonferrous grades means better value for your cutting dollar.

To find out more about Carboloy Extra-Performance and General-Purpose carbides, or low-cost nonferrous grades, call or write: Metallurgical Products Department of General Electric Company, 11157 E. 8 Mile Boulevard, Detroit 32, Michigan.

CARBOLOY®
CEMENTED CARBIDES

GENERAL ELECTRIC



"He took a dim view of the whole idea"

As reported by the foreman of a department at American Bosch, Springfield, Mass.: "We were milling a tapered slot in a 30 lb. housing for a CQ pump. When I told the operator we were going to "automate" the milling operation with Bellows Air Motors, he said "ixnay", he didn't want any part of it.

"You should have seen him at the end of the first day. He went home like he was walking on daisies. 'Baby', he said, 'with this Bellows equipment, milling these 30 lb. housings is a lead pipe cinch.'

"He was happy. We are happy. He gets home in the evening fresh enough to play around the golf course, and we, well, we're getting better tolerances, better finish, at less cost".

** from the case history files of The Bellows Co.*

Wherever Bellows Air Motors and Bellows air-powered production units are used to convert manually operated units to automatic machines, you'll find both operator and management singing their praise. To the operator, Bellows equipment brings less fatigue, greater safety — to management, a better product at lower cost.

1147-B

This may be helpful

If your catalog files on Bellows "Controlled-Air-Power" Devices are not up-to-date, ask us to send you a new complete catalog.

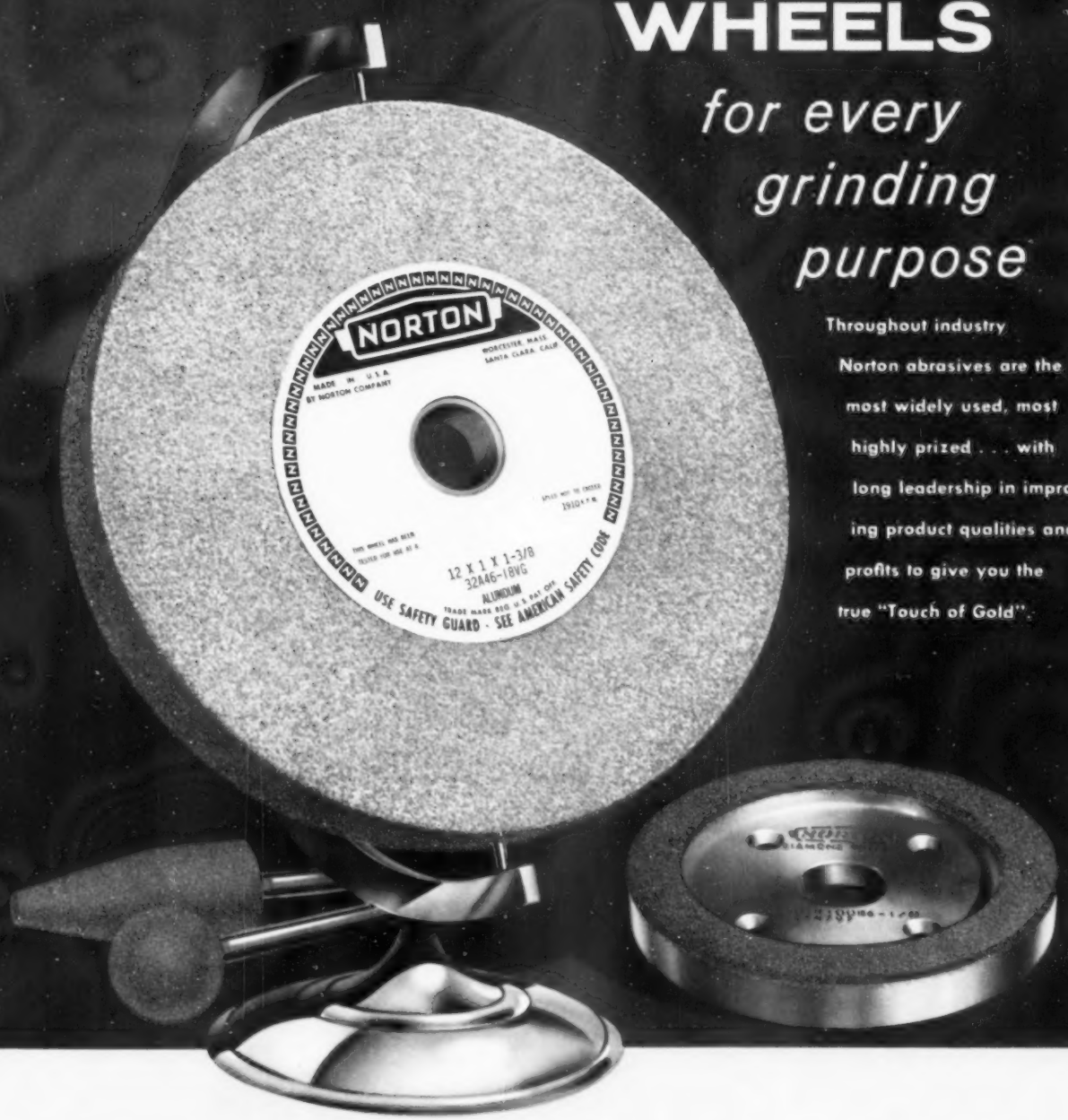
Write Dept. TE-958, The Bellows Co., Akron 9, Ohio. In Canada: Bellows Pneumatic Devices of Canada, Ltd., Toronto 18, Ontario

The Bellows Co.

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION

AKRON 9, OHIO

First in the **WORLD OF WHEELS** *for every grinding purpose*



Throughout industry Norton abrasives are the most widely used, most highly prized . . . with long leadership in improving product qualities and profits to give you the true "Touch of Gold".

Around the world and still expanding

Abrasive and Grinding Wheel Plants — Worcester, Mass.; Santa Clara, Calif.; Hamilton, Ontario; South Africa; England; France; Germany; Italy; Brazil.

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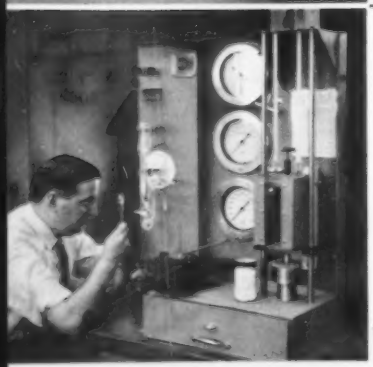
Headquarters for the "TOUCH of GOLD"

The world's largest source of abrasive research, manufacturing development, and service . . . all combining to aid your own production with improved grinding at lower cost.

BIG STEPS FORWARD Some of the latest and most important Norton developments—from top to bottom: a 32 ALUNDUM G-bond wheel, providing a unique aluminum oxide abrasive of outstanding performance plus the most advanced vitrified bond ever developed for precision, and semi-precision grinding . . . ; ALUNDUM TUMBLEX "S" bonded spheres for barrel finishing—spheres that get into areas where other shapes can't reach . . . A 44 ALUNDUM wheel, the most sensational non-premium abrasive ever developed for economical grinding — both rough and precision. Advancements like these are typical of the more than 200,000 different types and sizes of Norton abrasive products that cover every modern grinding job.

SELECTION IN ACTION For ordinary grinding jobs the vast amount of Norton know-how literature tells you how to select exactly the right wheels, while the many Norton films show the best grinding methods. But you may have new, unusual problems. Then, your distributor's Norton factory-trained specialist by studying your jobs can help you find the right solutions in quick time. And if necessary, he'll call in your regional Norton Abrasive Engineer for additional technical advice. With experts like these, the grinding wheels you need will be proved in action—on your machines.



DISCOVERING MUCH MORE Norton laboratory researchers, numbering over 180 scientists and technicians, are constantly seeking to find out a great deal more about abrasives and grinding wheels. Their chief interest is in developing new abrasives, new abrasive products and improved grinding techniques. Their many successes in research of this nature have stepped up grinding progress to lower your grinding costs.

THE RIGHT WHEELS ARE RIGHT AT HAND Your Norton distributor is careful to keep his stocks fully adequate to meet all needs of his area. That's true, too, of the stocks in the five big, strategically located Norton branch warehouses — in the Norton California plant — and of the gigantic stocks at Worcester in "Norton City" — the world's largest grinding wheel plant, Headquarters of the "Touch of Gold."

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Making better products . . . to make your products better

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BEHR-MANNING CO., Troy, N.Y. is a division of Norton Company

NORTON PRODUCTS
Abrasives • Grinding Wheels
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Coated Abrasives • Sharpening Stones
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4-58

the big attraction is...

CINCINNATI

inductron® and flamatic®

Selective Surface Heat Treating

When it comes to selective part surface heat treating, production executives and plant operating men have shown an unusual interest in Cincinnati equipment. For Cincinnati builds both induction and flame heat-treating machines. Highly versatile Inductrons and Flamatics can do such work as annealing, brazing, soldering, tempering, stress-relieving, shrink fitting—and meet your cost-per-piece requirements—on high production quantities or varied, small-lot runs.

For information, call in a Meta-Dynamics Division field engineer. Backed by the resources of Cincinnati's completely staffed and equipped heat engineering laboratories, your needs will be analyzed, your parts "test run", and specific, unbiased recommendations made. Of course, there's no obligation.

Built in 15, 30 and 50 KW capacities, the new Cincinnati Inductron operates at frequencies up to approx. 1000 KC for faster heating, thinner case, greater freedom from scale and distortion. Write for Catalog No. M-1993.

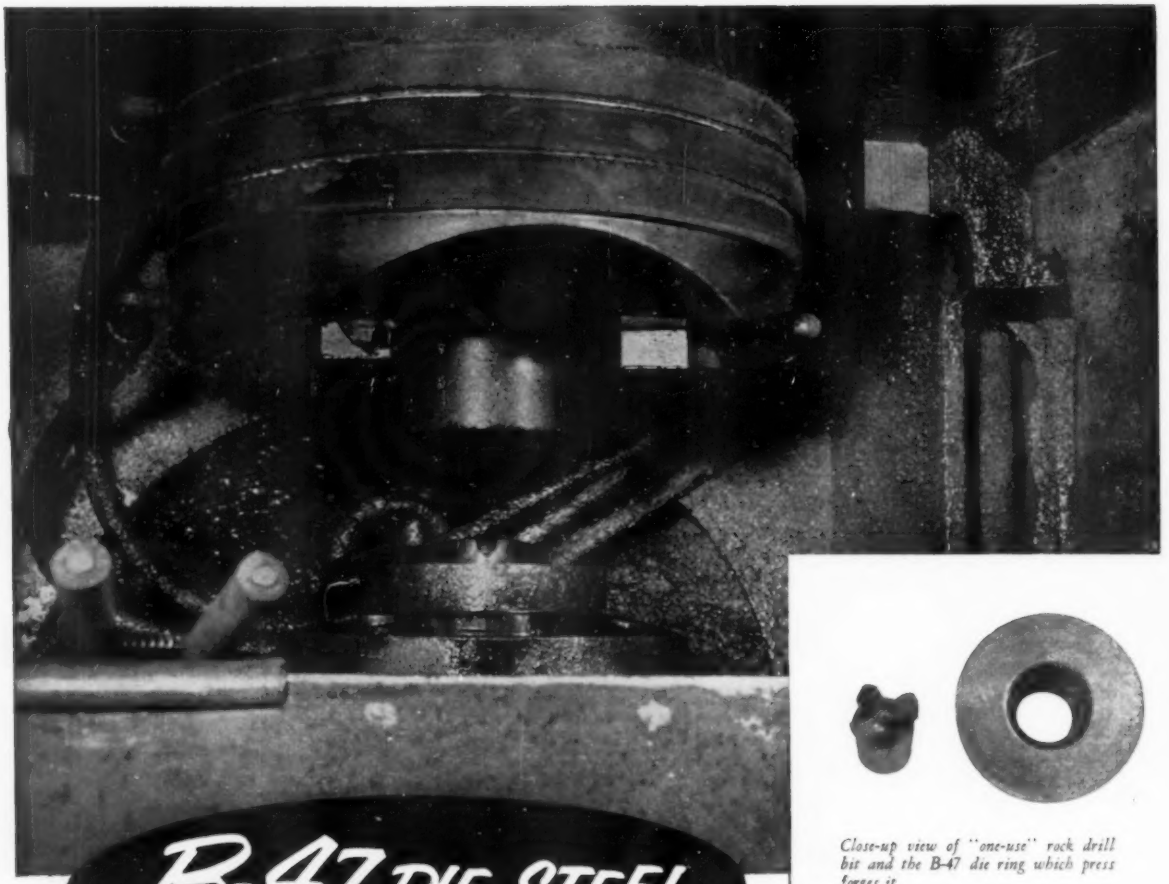
New Cincinnati Flamatic shown equipped with rotary spindle unit. "Building-block" construction adapts the Flamatic to an extremely wide range of flame heating applications. Write for Catalog No. M-2015.

inductron
flamatic
hardening machines

META-DYNAMICS DIVISION
Machines for Metal Forming and Heat Treating

THE CINCINNATI MILLING MACHINE CO.
Cincinnati 9, Ohio, U.S.A.

CINCINNATI



B-47 DIE STEEL

Close-up view of "one-use" rock drill bit and the B-47 die ring which press forges it.

INCREASED ROCK DRILL BIT PRODUCTION 330%

Write for BLUE SHEET on B-47

This concise four-page folder gives all needed handling and shop treatment details on B-47. Included is certified laboratory information on physical characteristics, and complete data on forging, annealing, hardening, tempering, etc. Ask for your copy.

ADDRESS DEPT. TE-9

A midwestern company increased their production of rock drill bits from 1500-3000 per die ring to a consistent total of more than 10,000 bits by switching to Allegheny Ludlum's B-47 die steel.

But of even greater importance, they claim, is the dependability of B-47:

"The less breakdowns we have, the less die changes we must make and the better production we get. Also, we are able to plan our production on the basis of being sure of the reliability of our dies."

Continued high production is necessary to make these special "one-use" bits competitive in today's market. B-47 practically eliminates unscheduled downtime caused by die failure.

A-L's B-47 is a tough hot work steel. It has excellent resistance to shock and abrasion at elevated temperatures. Also, it is especially good for those applications which require ruggedness at relatively high hardnesses.

Check your A-L representative today about Allegheny Ludlum's complete line of tool and die steels—a grade for every job. ***Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh, Pa.***

For nearest representative, consult Yellow Section of your telephone book.

For complete **MODERN** Tooling, call

Allegheny Ludlum

AL® FINE TOOL STEELS SINCE 1854

WBW 6847

Cadillac PLA-CHEK

Height gage and micrometer settings are 5 to 20 times faster with Cadillac PLA-CHEK than with other methods of comparable accuracy. Less than 15 seconds establishes *any* dimension within a 24" range to limits of less than .0001". No auxiliary gage blocks necessary—PLA-CHEK is totally self-contained. Dimensions are taken from the surface plate or from a base line on the work. Send coupon TODAY for complete details!

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Cadillac GAGE COMPANY
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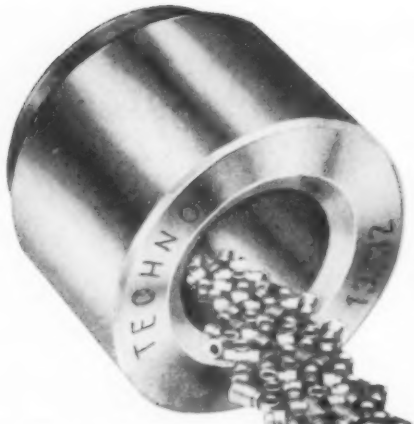

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TEMPLATE DRILL BUSHINGS AND WORK LOCATORS

The revolutionary bushing that can be easily and concentrically installed with only a hand FLARING TOOL and HAMMER . . . Designed by tool engineers, FLAR-A-LOCK fills the need for a LOW COST TEMPLATE DRILL BUSHING for either METAL, MASONITE or PLASTIC TOOLING . . . A Bushing that is highly resistant to wear and retains perfect alignment during the longest production runs.

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an attachment which
Automates any of your present machine tools . . . by gauging the piece in process
DIAL YOUR SIZE control to tolerances of .000008"

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all types including internal, surface and centerless

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your key to precision automation

The remarkable new Electro-Autosizer will feed back I.D. data from a finished piece to machine controls so that the mating workpiece being ground fits exactly . . . *in one chucking.*
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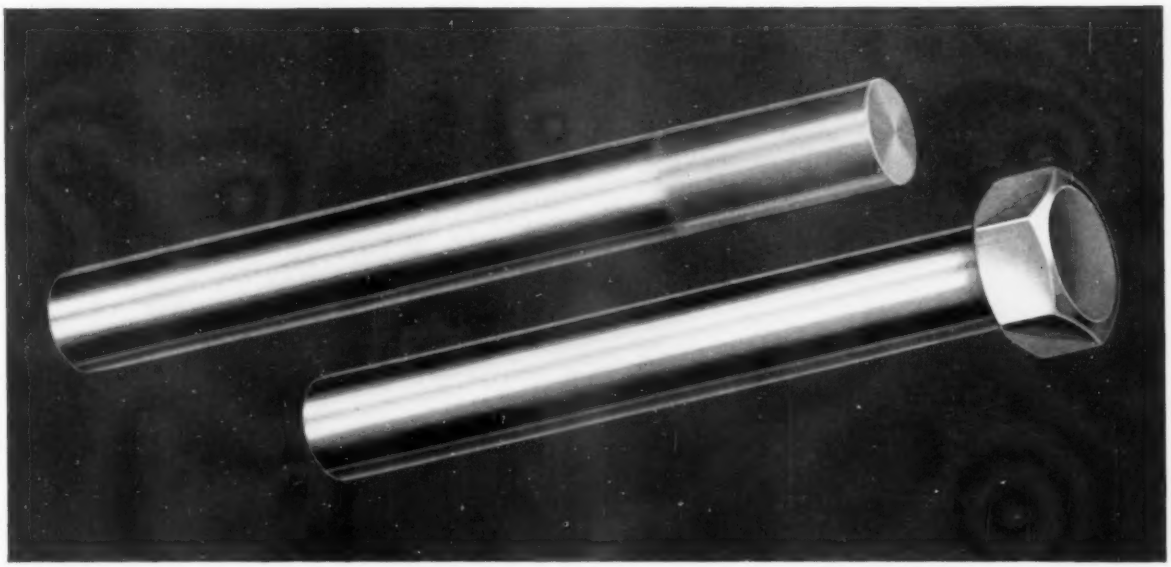
FORGING: COPPER • BRONZE • ALUMINUM • MONEL AND STAINLESS STEEL

Die Life Increased Up To 400%

with TOCCO Induction Heating*



● Naval Bronze, Silicon Bronze, Copper, Aluminum, Monel and all types of stainless steel are heated for forging at the H. M. Harper Co., Morton Grove, Illinois. Regardless of material TOCCO can be profitably applied to brazing, heat-treating and forging operations in almost any metal-working plant.

Production Up—In addition to the very important savings in forging dies, TOCCO has increased production to as much as 265% of output possible with former heating methods. On the 1" type 303 Stainless machine bolt blanks shown here TOCCO upped production from 75 to 200 parts per hour, using 35 K. W., 10,000 cycles.

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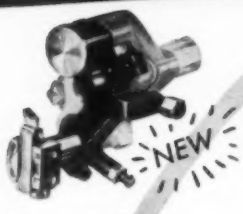


Swing Tool Attachment

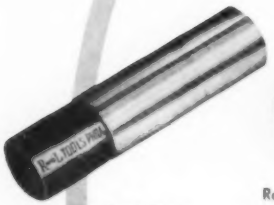
Recessing Tool

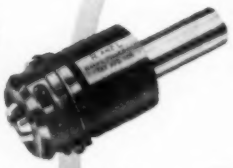
Tap and Die Holders

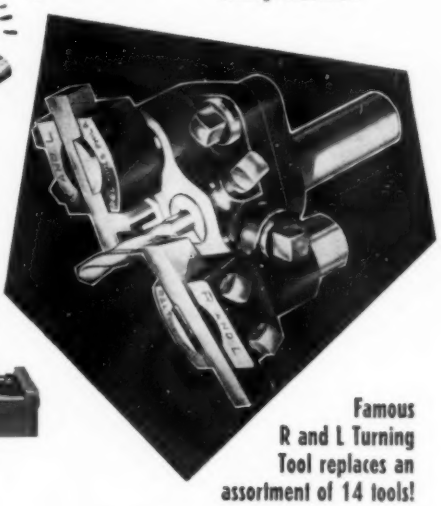
Knurling Tool

On and Off Center Drilling Attachment

Tool Slide Knurling Tool

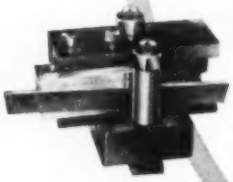

Revolving Stock Stops

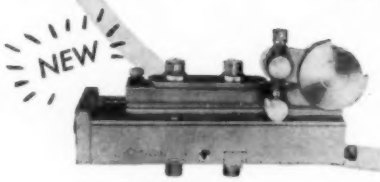

Releasing Die Holders for Acorn Dies


Famous R and L Turning Tool replaces an assortment of 14 tools!

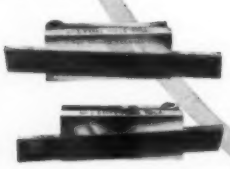
Cross Slide Knurling Tool

Swing Tool

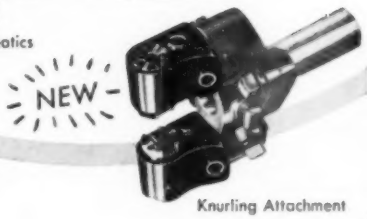

Universal Tool Post



Tool Holders for Multi-Spindle Automatics

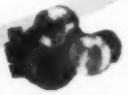

Cut Off Blade Holders

Backrest Holder for Turret



Knurling Attachment

Carbide Backrests


Roller Backrests

TE-9

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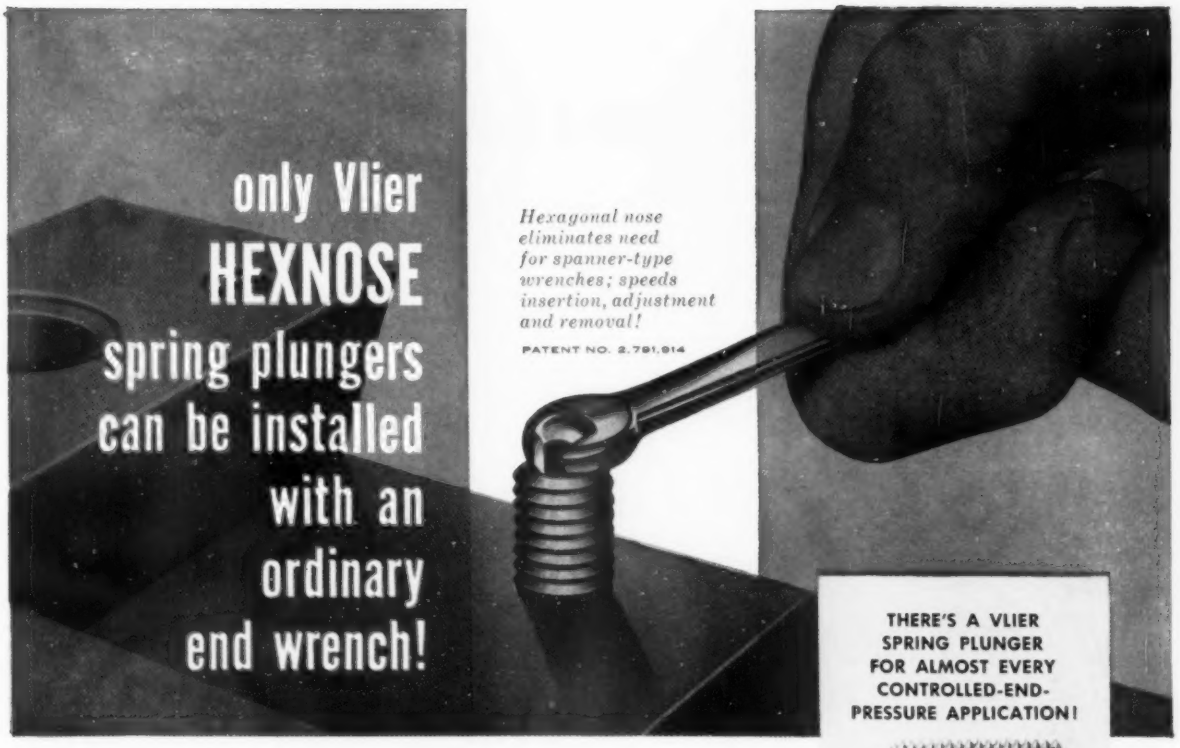
only Vlier HEXNOSE spring plungers can be installed with an ordinary end wrench!



Hexagonal nose eliminates need for spanner-type wrenches; speeds insertion, adjustment and removal!

PATENT NO. 2,791,914

Whatever your spring plunger application—tooling or original equipment—you'll like the ease and speed with which Vlier Hexnose Spring Plungers can be installed.

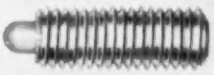
No more hunting for clumsy-to-use spanner-type wrenches or special screw drivers—any ordinary end, socket or crescent-type wrench will do the job quickly and easily.

Since the plunger nose is always easily accessible, the Hexnose really pays off where periodic adjustments must be made. Hardening both body and plunger assures body life. Available in both standard and light end pressure models; 11 sizes.

THERE'S A VLIER SPRING PLUNGER FOR ALMOST EVERY CONTROLLED-END-PRESSURE APPLICATION!

Standard
Primarily used in ordinary jigs and fixtures.

Silvernose
Light end pressure for repetitive die applications.



Plastic Nose
For use with aluminum, brass and other soft materials.

Hexnose
For greater ease in installing, adjusting and removing.

Same sturdy construction as other Vlier spring plungers

1. Large bearing surface overcomes binding, assures perfect alignment of the plunger at any extension.
2. Concentricity between plunger axis and body diameter held to .0015" T.I.P.R.
3. Rust-proof finish and National Coarse Class 2A threads prevent freezing in threaded hole.
4. Plunger end telescopes completely within body. Case-hardening assures extreme wear resistance. Ductile core overcomes brittleness and hazards of fracturing under impact, common with hardened, high carbon steels.
5. Spring pressures are accurate, uniform and dependable.
6. Accurately radiused nose speeds loading and unloading of jigs and fixtures.

Send for your 1957 Vlier catalog.

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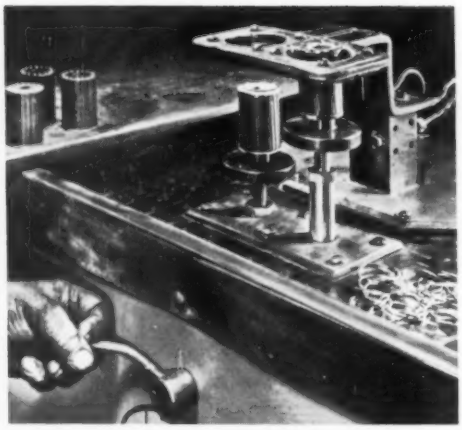
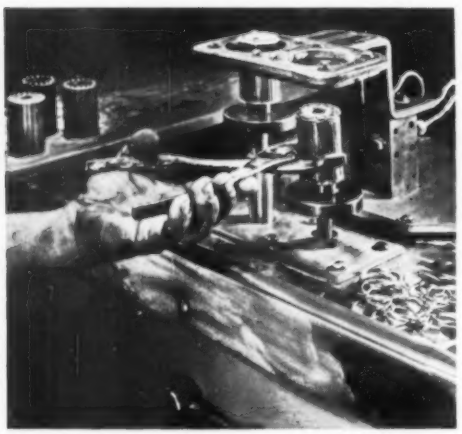
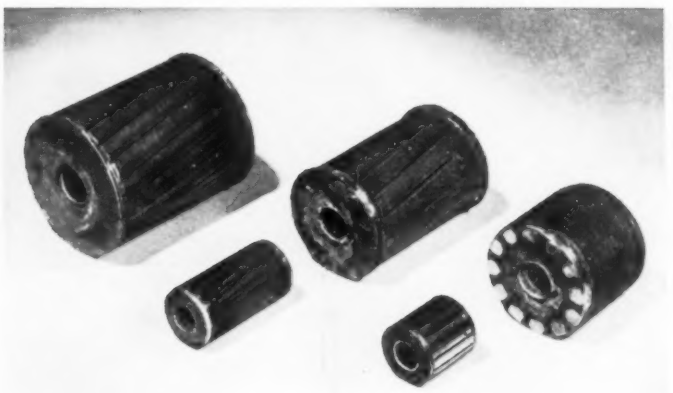


Handy & Harman Sil-Fos Silver Brazing is Used by Induction Motors Corp. in 5427 Different Motors





FIRST, BULLETIN 20

This informative booklet will get you off to a good start on the values, techniques and economies of low-temperature silver brazing. A copy awaits your request.

Induction Motors Corp. of Westbury, New York, and Maywood, California, has built an outstanding reputation as a designer and manufacturer of sub-fractional horsepower motors...for 5427 high performance reasons.

This large variety of motors, blowers and fans for an equally large variety of applications, stems from 15 basic motor frame sizes, depending on length, pole materials, windings, groove angles and the like.

Handy & Harman silver alloy brazing is concerned with brazing the rotors. Each rotor (whatever the size) is joined by a preformed ring of Handy & Harman SIL-FOS, by induction heating – at an alloy cost that is reckoned in pennies. For example, the alloy cost per ⅞" frame is two cents per joint, or four cents per complete assembly.

That's an example of the economics of silver alloy brazing. Performance requirements are quite another thing – and they are unquestionably stringent. Many of these motors are used in aircraft and missile work and must, of course, meet the most extreme environmental conditions.

Strength alone would be reason enough to discuss the merits of silver alloy brazing . . . and to point out as a reason for its wide acceptance throughout industry. The facts are that there are many more benefits; gas- and leak-tightness, thermal and electrical conductivity, ductility, and production economy – are all *joint qualities* of silver alloy brazing. At any time, we will be happy to discuss any or all of these qualities (and others), as applied to your product or production method. The benefits are large and you can enjoy them.

Your No. 1 SOURCE OF SUPPLY AND AUTHORITY ON BRAZING ALLOYS

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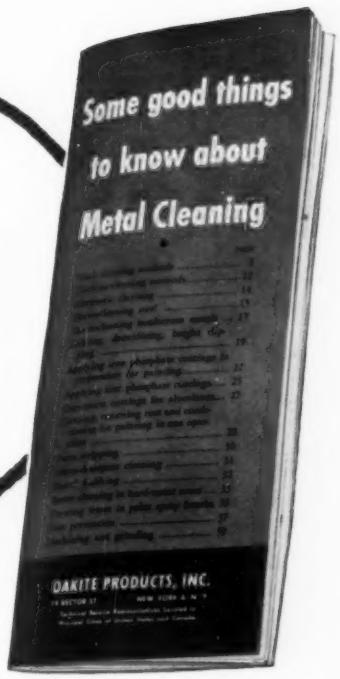
WHICH METAL-CLEANING JOBS WOULD YOU LIKE TO IMPROVE?



¶ Are you cleaning metal in the most economical way? *See page 9 of Oakite's FREE booklet on Metal Cleaning.*

¶ Are you cleaning metal the fastest way? *See page 12.*

¶ Do you need room-temperature cleaning combined in one operation with temporary rustproofing? *See pages 12 and 14.*

¶ Do you know the advantages of *alkaline* pickling? *See page 21.*

¶ Have you compared the values of iron phosphate coating and zinc phosphate coating in preparation for painting? *See pages 22 and 25.*

¶ Can you use a cleaner that removes rust and oil at the same time; often eliminating all need for pickling? *See page 30.*

¶ Do you have trouble stripping epoxy resins, pigment residues, phosphate coatings and under-paint rust? *See page 31.*

¶ How do you clean parts that are too large to be soaked in tanks or sprayed in machines? *See page 31.*

¶ Are you getting full profit out of your finishing barrels? *See page 32.*

¶ What do you do when oversprayed paint neither floats nor sinks in your paint spray booth wash water? *See page 35.*

¶ Do you need better protection against rusting in process or in storage? *See page 37.*

Here is the full table of contents of Oakite's 44-page illustrated booklet called "*Some good things to know about Metal Cleaning*".

Tank cleaning methods

Machine cleaning methods

Ultrasonic cleaning

Electrocleaning steel

Electrocleaning nonferrous metals

Pickling, deoxidizing, bright dipping

Applying iron phosphate coatings in preparation for painting

Applying zinc phosphate coatings

Conversion coatings for aluminum and zinc

Cleaning, removing rust and conditioning for painting in one operation

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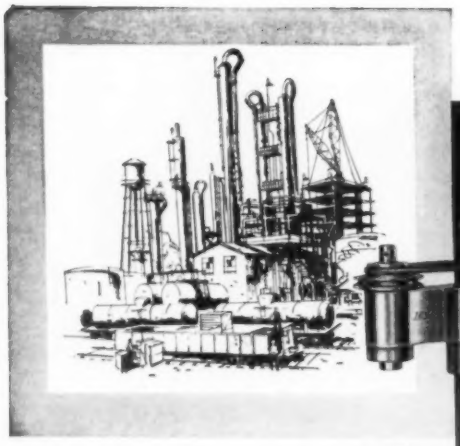
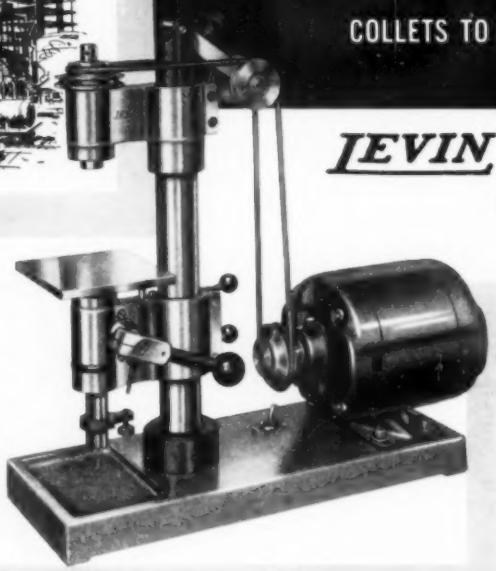


SMALL DRILLS MUST BE HELD IN PRECISION COLLETS TO ASSURE ACCURACY

LEVIN® MICRO DRILL PRESS FOR VERY SMALL HOLES DOWN TO .002"



SPECIFICATIONS:
Size of table is 3-3/4" x 4". Maximum table travel is 1-1/2". Greatest distance between table and end of spindle 4". Preloaded ball bearing spindle with four speeds 1725, 2600, 3000, 4700 RPM. Motor 1/2 HP, 110V, 60C. The micro-drill press may also be had with a 3450 RPM motor, doubling the above speeds.

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PROVEN TO BE FAR ADVANCED OVER OTHER TYPES OF HOLDERS!

Save time on production and non-production jobs. KDK Tool Holder and Bars give unlimited operations on set-up. 5 bars will hold 9 tools with 24 combinations that can do most any job and save hours of set-up time. KDK permits quick change of bars, increasing production as high as 400% over other type holders.

- **REDUCES SET-UP TIME AND INCREASES MACHINE TIME**
- **REDUCES OPERATOR FATIGUE AND INCREASES TOOL LIFE**

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A Complete Sheet Metal Shop in One Machine

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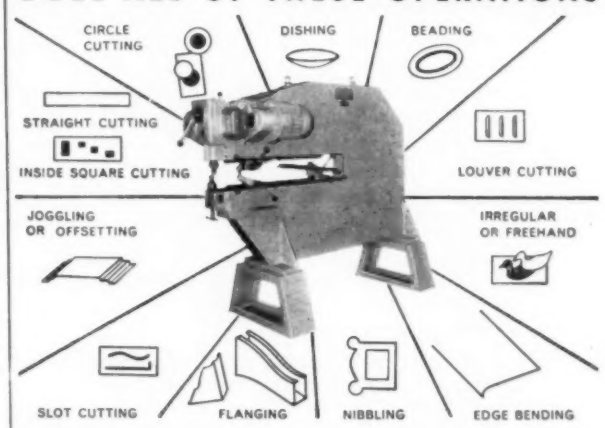
DOES ALL OF THESE OPERATIONS



★ CUTS MILD STEEL UP TO 11/32"

The one machine that's sure to save time, labor and material when you work sheet or plate. Eliminates expensive die costs—easy to operate. 7 sizes to choose from.

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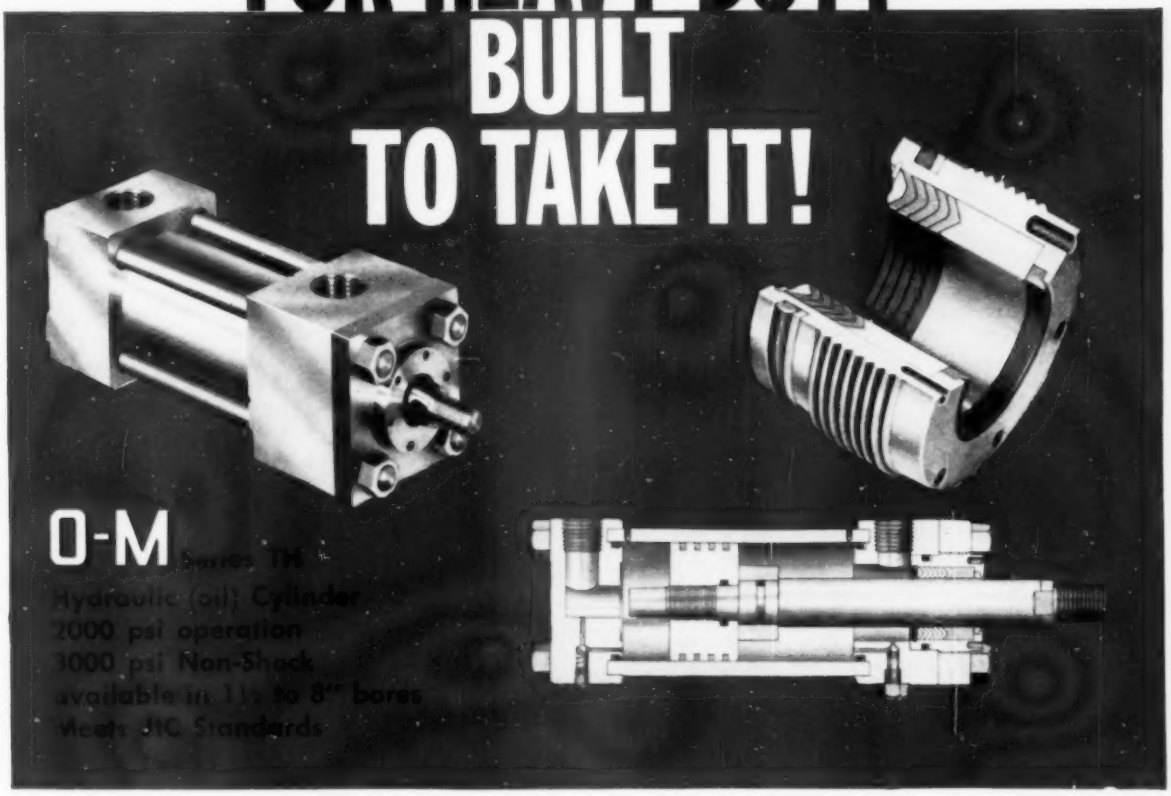

Every engineering and construction detail of the improved O-M Tie-rod Hydraulic Cylinder adds to its overall operating efficiency under heavy work loads, assuring maximum smooth performance with minimum maintenance. It is ruggedly constructed of heavy walled, seamless steel tubing microhoned to minimize friction. The rolled steel heads are recessed to confine the tube, prevent breathing and to provide additional protection against leakage under the most severe conditions. Heads can be rotated independently at 90° intervals for convenient port location. The piston rod is of stress relieved, high tensile steel, hard chrome plated, turned, ground and polished. The rod gland cartridge that is threaded for quick, easy removal, is accurately piloted in rod head to assure perfect alignment, also serves as pilot for cylinder mounted on rod end. Rod gland contains extra long bronze rod bearing for maximum support of piston rod.

Vee type, non adjustable, self compensating, rod gland packing provides multiple lip seal. Cartridge "O" ring, with leather back up furnishes a positive seal. Rod wiper or interchangeable metallic scraper prevent dirt from entering cylinder on "in" stroke. A complete selection of mounts is available.

These and many other features are described in detail in our latest catalog No. 105. Write for your copy TODAY or consult your local O-M representative.

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☐ Have representative call
☐ Send Bulletin 105

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Company_____

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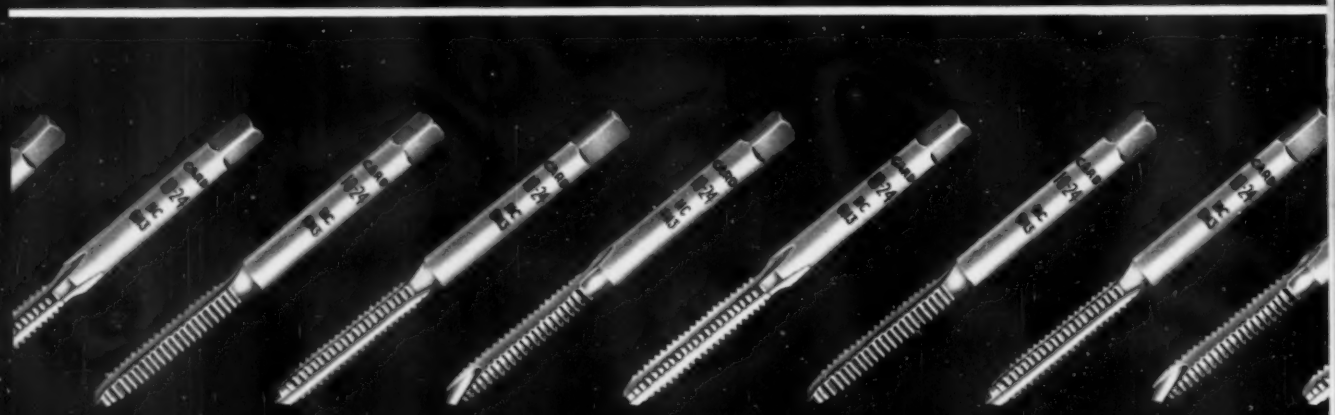
As these torpedoes are uniform



...So Card machine screw taps are uniform, too

Your production's consistent ...because Card taps are uniform

Your first step in consistent production performance is the cutting tool itself. Because Card machine screw taps are identical they keep production up to par — and predictable. Shopmen know about the uniformity of Card taps. Card gages are like that, too.

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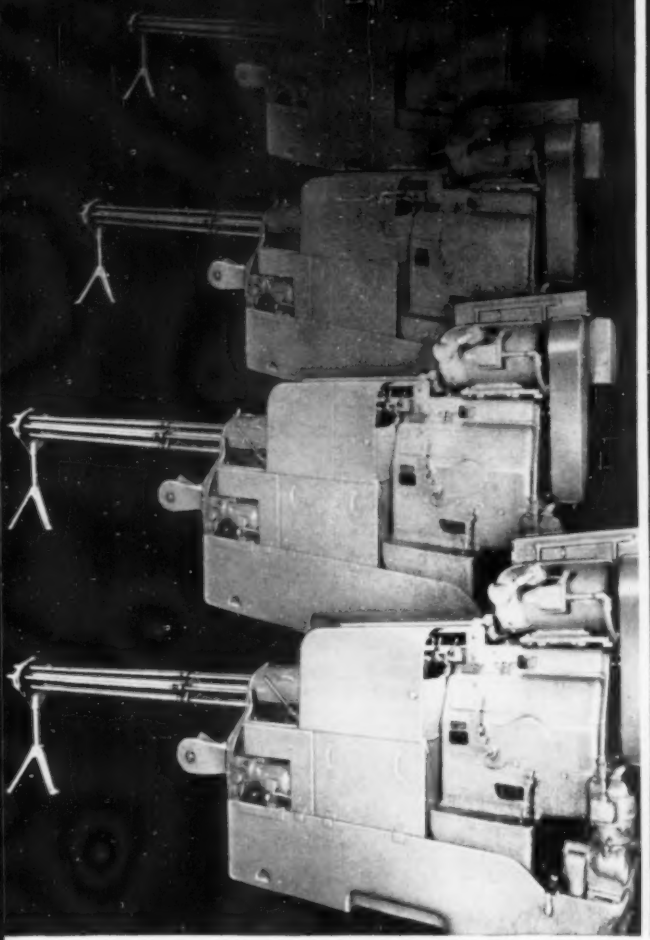

This brand cuts down your reamer usage, production time and costs!

The more you use reamers – high speed steel or carbide –

the more you need Union

Union reamers, high speed steel or carbide, are all alike in one feature. Their consistent top quality reduces your production costs and improves your production quality. Union also manufactures drills, milling cutters, gear cutters, end mills, hobs and inserted blade cutters. **Available nationally through Union Distributors** and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

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See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

are you GEARED for COMPETITION?

the SYKOMATIC

NEW Magazine Feed GEAR SHAPER

SPECIFICALLY DESIGNED TO CUT COSTS IN THE QUALITY PRODUCTION OF SPUR AND SINGLE HELICAL GEARS

Here is a dramatically new development in gear cutting machines produced by the Sykes Organization — known throughout the world for quality and workmanship in the specialized production of gear generating machinery.

The Sykomatic, demonstrated at the ASTE Show, incorporates more extraordinary and practical features than any other gear shaper in its class; features which you will find invaluable in the production of straight and helical gears in quantity which can only be produced by the shaping method. The rotary turret magazine holds a number of gear blanks depending upon the size. The turret loading arrangement reduces labor costs considerably by making possible the simultaneous operation of several machines at full capacity. The application of transfer line equipment to the Sykomatic can be effected when necessary and without difficulty. The automatic cycling or single component action may be engaged at will.

Other advantages incorporated into the Sykomatic are too numerous to list here. Why not write for our new Sykomatic Gear Generator Brochure with complete information and specifications for this economical, vastly more efficient gear generator.

Installations of all Sykes Gear Machines are supervised by our own factory trained sales engineers and carry a one year service guarantee.

For detailed information and specifications, write for Brochure. For information, contact:

SYKES MACHINE & GEAR CORPORATION

744 BROAD STREET • NEWARK 2, NEW JERSEY

Telephone: MArket 3-3290 • Cable: Sykes Newark

Represented in Canada by Sykes Tool Corp. Ltd., Georgetown, Ont. and Montreal, P. Q.

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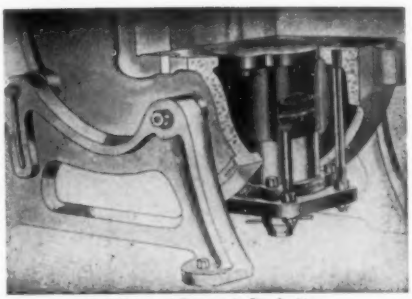
DIE CUSHIONS

Offer 4-Point SUPERIORITY Over Springs, Rubber Bumpers

1 Adjustable compression provides ideal blank holding pressure.

2 Bronze bearing surfaces give maximum stability.

3 Constant pressure assures equal loading at start and finish of draw.



Full Universal Pneumatic Die Cushion

4 Simple mounting, either bolster or press bed. More stable installation possible due to method of suspension.

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DAYTON ROGERS *Manufacturing Company*

MINNEAPOLIS 7R, MINNESOTA

ASTE Western Tool Show, Los Angeles, Sept. 29-Oct. 5.

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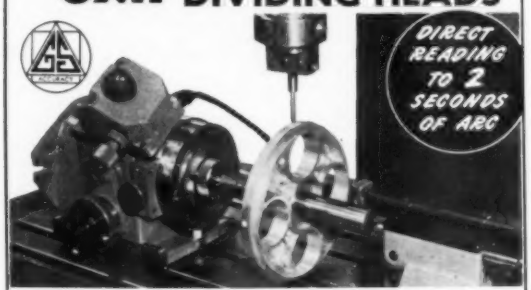
for PRECISE & ACCURATE ANGULAR POSITIONING IN INSPECTION & PRODUCTION

OMT OPTICAL DIVIDING HEADS



This new OPTICAL DIVIDING HEAD is a MUST for the critical indexing work which industry requires today. SPEED and EXTREME ACCURACY of indexing that would be impossible with mechanical type heads are outstanding features of the **OMT** OPTICAL DIVIDING HEAD. MODERATELY PRICED.

These PRECISION-BUILT optical dividing heads are constructed for long and trouble-free life.

SPECIFICATIONS

OPTICAL SCALE READING DIRECT TO 2 SECONDS — SWING 6½" — MAX. DIST. BET. CENTERS 14½" when used with Std. Base furnished.

SIZE OF HEAD: Length 7½" Width 6¾" Height 7½"

BASE PLATE DIMENSIONS 30" x 15" x 6" which is furnished as Std. Equip't.

OTHER MODELS READING DIRECTLY TO 1 MIN. AVAILABLE

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For Every Metal

Manufacturers for years have found that STEELGARDS immediately and economically solve their rust problems because these very effective rust preventives stop rust two ways: (1) they supply the desired protective surface coating; (2) they arrest action under the surface coat.

STEELGARDS are a series of every conceivable type of rust preventive. The amount of STEELGARD deposited on the metal can be regulated by the type selected and the dilution used.

STEELGARDS . . .

1. **Are far superior to conventional oils, vaselines, petrolatums, waxes, greases.**
2. **Can be applied to wet or dry surfaces, inside or out, on metal to be covered or uncovered.**
3. **Adhere to all metals uniformly and continuously.**
4. **Are non-flammable, practically odorless.**
5. **Are non-staining in most grades.**
6. **Are applied by brush, spray, dipping.**
7. **Can be removed easily without special equipment.**
8. **Provide greater economy, stop waste and mess.**

STEELGARDS . . .

Are made for use on *all* metals including cast iron, cast steel, etc. Some produce invisible films which cannot be seen and which are not sensitive to the touch. Others produce oily coatings . . . some, dry waxy coatings. Others can be painted over without removal and some combine the properties of detergency along with reduced surface tension. Some burn off completely in annealing while others do not.

STEELGARDS are available in the type desired for water phase application. Other grades are used as received or cut back with solvents or mineral oils.

Write us on your letterhead about your rust problem. No matter how difficult, there's a proven grade of STEELGARD rust preventive to solve it.

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With this **new** socket head cap screw you can Pre-Load without indentation!

the new P-K® PRE-LODE

Now . . . Parker-Kalon's new PRE-LODE Socket Head Cap Screw gives you *greater bearing surface under the head than ever before!* With this new head, a research achievement resulting from the combined efforts of the Socket Screw Manufacturers' Technical Committee, you can now apply higher torque . . . pre-load the fastener for maximum holding power without danger of marring or indenting softer materials in which the screw engages. This means greater load carrying capacity and better functioning in holes having a greater body clearance. P-K's PRE-LODE Socket Head Cap Screws are designed for high tightening. In many cases, the socket has been enlarged to allow more wrenching area. Standard sizes ¼" to 1" PRE-LODE Socket Head Cap Screws are *Size-Marked* for easy identification, and are manufactured to exacting specifications. Available now from your authorized P-K distributor at no increase in cost. Write today for complete technical data and samples.

Sold Everywhere Through Leading Industrial Supply Distributors.

PARKER-KALON® *PRE-LODE Socket Head Cap Screws*

PARKER-KALON DIVISION, General American Transportation Corporation, Clifton, New Jersey.

Only Parker-Kalon offers both PRE-LODE and SIZE-MARK in Socket Head Cap Screws

TYPICAL SCHRADER SIMPLIFIED VALVE DESIGN

. . another reason why your air system installations will perform best.

A—Mounting holes always conveniently located.

B—"O" rings used for surest airtight seal.

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D—Stainless steel springs: rust resistance, longest service life.

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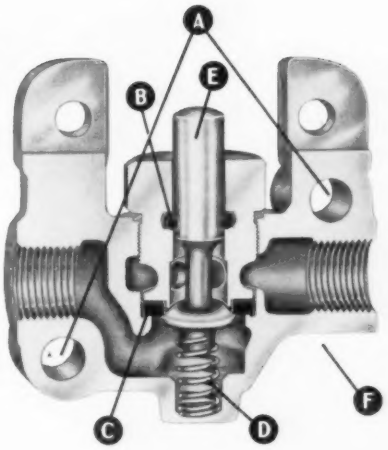
F—All parts designed for greatest air flow, longest life and simplicity of replacement and interchangeability.



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2 and 3-WAY VALVES (Roller Lever)
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3-WAY SINGLE SOLENOID VALVES
4-WAY DOUBLE OR SINGLE SOLENOID VALVES (Sub-Base)
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4-WAY VALVES (Pilot Operated)
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Schrader makes complete lines of Air Control Valves for everything you need

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QUALITY AIR CONTROL PRODUCTS

This valve gets a leak-proof seal from a Blanchard Surface Grinder

"The Blanchard Surface Grinder is one of the most important improvements in our modernization program." This report comes from the Commercial Refrigeration Division of Bendix-Westinghouse Automotive Air Brake Company—makers of power and condensing units for refrigeration equipment.

The Blanchard No. 18 Surface Grinder puts a surface of 5 micro inches or better on Bendix-Westinghouse valves at the rate of 75 pieces an hour.

A Blanchard Model 18 Surface Grinder is used to finish grind valve plates used in Bendix-Westinghouse electric refrigeration compressors. They say: "This operation is very important, because—with a surface finish of five micro inches or better—we get a perfect seal on our gaskets and valves, eliminating the possibility of leakage."

Is there room for improvement in *your* surface grinding? For best results...

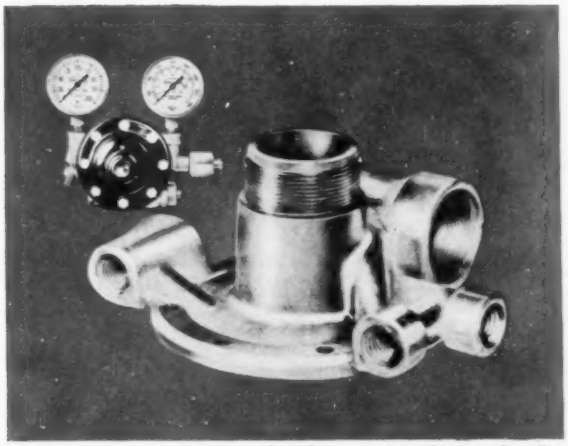
Write today for your free copy of "Work done on the Blanchard," fifth edition, and "The Art of Blanchard Surface Grinding," fourth edition.

PUT IT ON THE BLANCHARD

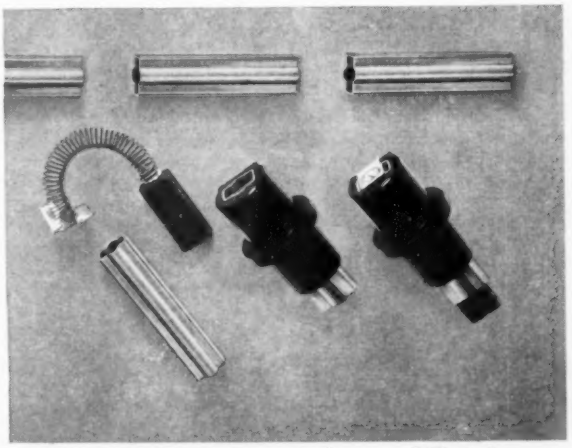
THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

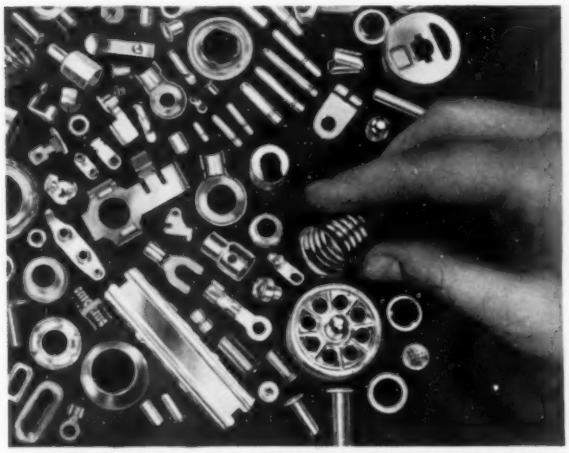
TAKE A FRESH LOOK at the way you are fabricating metal parts. Cost-cutting possibilities are almost unlimited with these Anaconda pre-formed mill products and press products.



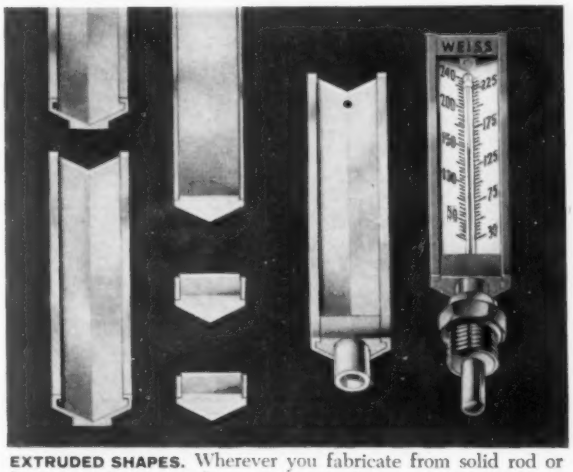
DIE-PRESSED FORGINGS, made of twice-wrought metal, offer superior uniformity, denseness, accuracy. *Savings:* replace more costly built-up assemblies—often are less in first cost than sand castings—require minimum surface machining to size—simplify secondary operations—lower tool cost—lower finishing cost.



SPECIAL-SHAPE TUBES can, as in the case of Electrolux, save several steps in arriving at a finished part. Brass electric-motor brush holder (above) is cut economically from long lengths of tube pre-shaped to accommodate both brush and spring. Uniform accuracy of all dimensions helps provide good brush stability.



MULTIPLE-PLUNGER AND PROGRESSIVE-TOOL-PRESS PRODUCTS are cutting costs throughout industry—often over 50%. Main reasons: The American Brass Company's complete design engineering service, long experience, specialized production equipment, a big selection of stock tools. Metals: copper, copper alloys, nickel, iron, steel, stainless steel, or aluminum.



EXTRUDED SHAPES. Wherever you fabricate from solid rod or bar—or castings—consider savings in machining, tooling and scrap by use of extruded shapes. Albert A. Weiss & Sons substituted two extruded shapes, above, for a sand casting—cut cost of thermometer case 41%, got an additional 30% saving in assembly because of consistently uniform dimensions.

HERE are four immediate approaches to cutting costs. Re-evaluate your designs and fabrication methods with these short cuts to finished products in mind. Wherever you spot a possible saving, send a sample, drawing, or description—with the quantity you need, the metal or properties you require—and ask for a quotation. Address: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Limited, New Toronto, Ontario. 5853

DIE-PRESSED FORGINGS • SPECIAL-SHAPED TUBES
EXTRUSIONS • FABRICATED METAL GOODS

products of

ANACONDA®

Made by The American Brass Company

Do your machines have a Built-in Future?

When you buy new hobbing machines, gear your thinking to the future.

It is not enough just to meet today's production requirements. The machines you buy now must have "built-in" features that will measure up to the high-speed production demands of tomorrow.

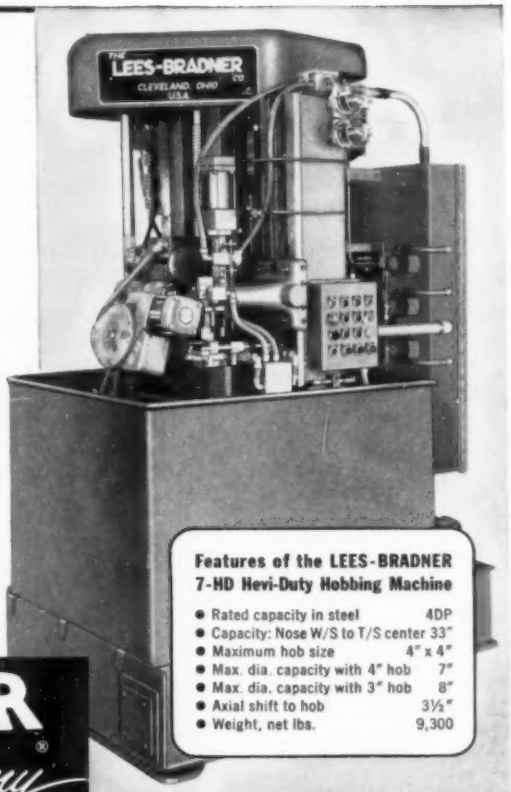
The Lees-Bradner Company manufactures a complete line of hobbing machines designed to fulfill varied requirements.

For example, this 7-HD Hevi-Duty Single Spindle Hobbing Machine is built to hob *today* at *tomorrow's* higher feeds and speeds. It's a heavy, powerful machine equipped with a new hob head featuring an axial shift of 3½ inches.

The 7-HD is also available in 4 and 6-spindle rotary models.

For complete technical information on Lees-Bradner "years ahead" Hobbing Machines send for your free 7-HD brochure . . . or contact the Lees-Bradner representative in your area.

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER



Features of the LEES-BRADNER 7-HD Hevi-Duty Hobbing Machine

- Rated capacity in steel 4DP
- Capacity: Nose W/S to T/S center 33"
- Maximum hob size 4" x 4"
- Max. dia. capacity with 4" hob 7"
- Max. dia. capacity with 3" hob 8"
- Axial shift to hob 3½"
- Weight, net lbs. 9,300

the LEES-BRADNER Company

CLEVELAND 11, OHIO • U.S.A.

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-272-1

USE
GATCO ROTARY BUSHINGS
WITH
Your Boring Bars
FOR
ACCURACY
and
SAVE WEAR

Eliminates expensive tool construction — Reduces tool wear — Prevents seizure and pilot breakage — Especially adapted where precision is required.

ORIGINATORS OF THE ROTARY BUSHING

GATCO ROTARY BUSHING CO.

The inner race o. the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work—or both.

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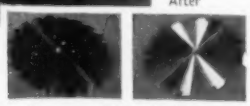
FOR NATIONALLY FAMOUS HEINEMANN SAWS

Below: Heinemann Saw before and after Brightboy polish. Left: Before; Right: After



A mirror like Brightboy finish not obtainable by any other form of polishing

"Brightboy's unique RUBBER and ABRASIVE action produces the superb finish which reflects the high skill of our craftsmen and our use of the finest materials", says Mr. William Heinemann of Heinemann Saw Corp., Canton, Ohio.

FOR MANUFACTURING & MAINTENANCE OF TOOLS SINGLE-STEP BURRING, CLEANING, FINISHING, POLISHING

An Entirely New Concept of Abrasive Applications

Stock numbers match-mated to your requirements. Silicon Carbide and Aluminum Oxide grains, from extra fine to extra coarse. Soft, firm and tough rubber binders. Ask your dealer for catalog listing grains, textures, applications, machine speeds. Write us if he cannot supply you or on any problem in which finishing is involved.

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America's Pioneer Manufacturer of Rubber-Bonded Abrasives

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RUBBER CUSHIONED ABRASIVES

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WAY GUARDS

- KEEP WAYS CLEAN
- SAVE THE MACHINE
- SAVE THE MAN

Made by experienced men to fit your needs.

WRITE FOR DETAILS

CAN-PRO Corporation
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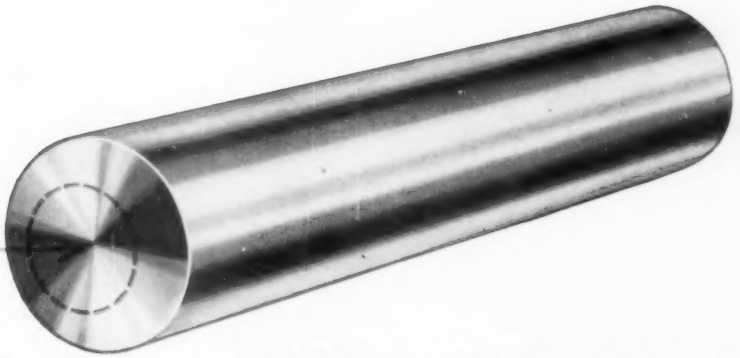
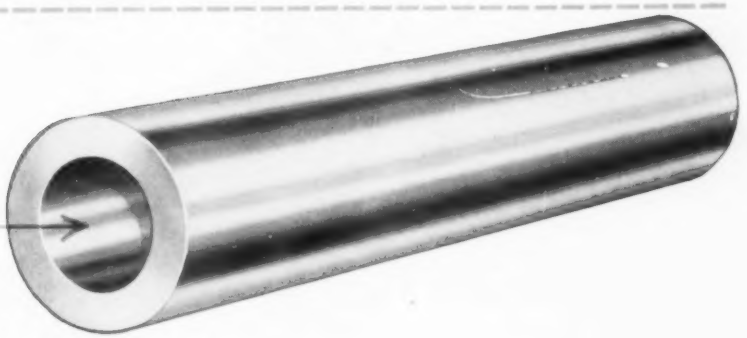
Buying bar stock for hollow parts?

Why pay for all this steel



When you can start with this?



Buy TIMKEN® seamless steel tubing

If you're making hollow parts, and bore cut *solid* bar stock, you're paying for steel you don't use. But Timken® seamless steel tubing comes with *the hole already there.* You pay only for steel you use. On top of this saving, you cut machining costs. By eliminating that unnecessary boring operation, you free part of your screw machines for other jobs—add machining capacity without adding machines.

Our engineers will be glad to recommend the most economical tube size for your hollow parts job. By studying your problem and making recommendations, they'll save you money—and the Timken seamless steel tubing they suggest will be guaranteed to clean up to your finished dimensions.

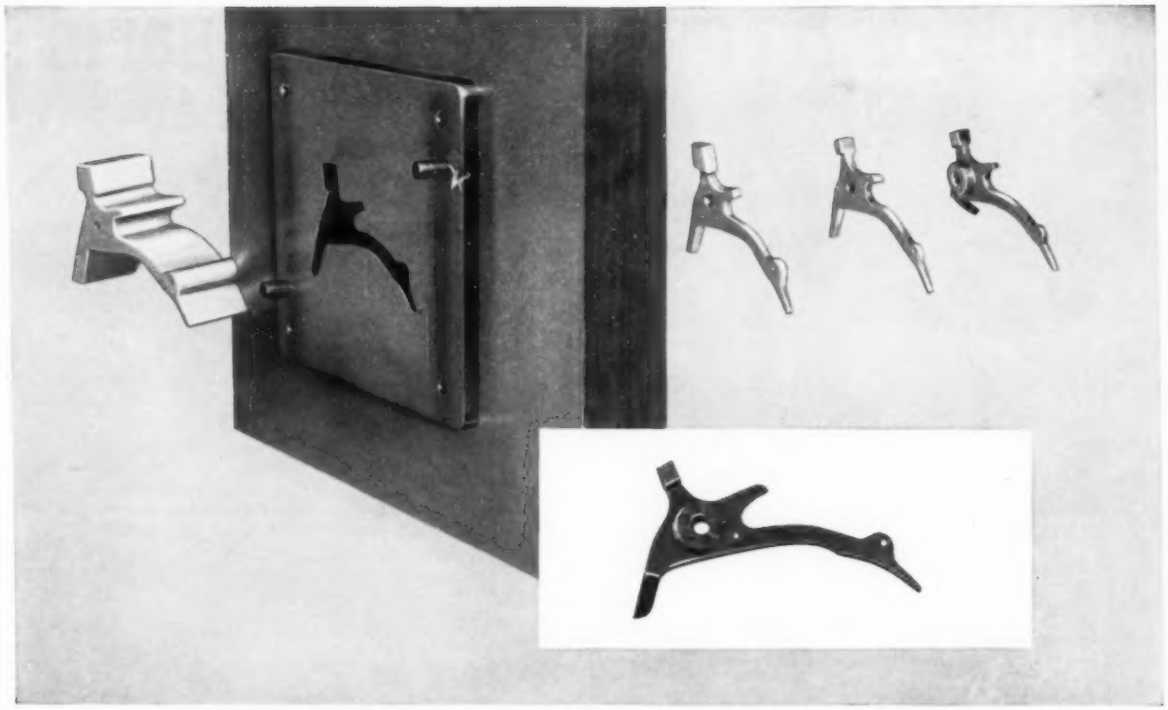
The piercing process by which Timken seamless steel tubing is made is basically a forging operation. You get *fine forged quality*—a uniform spiral grain flow for greater strength, and a refined grain structure. And through our rigid quality control uniform quality is maintained from tube to tube, heat to heat and order to order.

The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING



Progression of pieces, all UHB-711 Tool Steel: punch, die, blanked part, drilled and finish machined part, final assembly.

UDDEHOLM UHB-711 Tool Steel Solves Die And Product Problem

How many ways can a good tool steel work for you? In your die? In your product? Saving production steps? Uddeholm's heavy duty, oil hardening UHB-711 recently did all three. As a result, Harvard Tool & Die Co., of Hartford, Conn., was able to blank a part that once had to be produced entirely by machining.

The part, a small latch assembly, supplied to General Electric, had been machined from a ½" thick and 4" wide hot rolled bar. Production was costly. Small in section, the part was subject to fatigue failure at its point of stress. Yet its critical function permitted no such failure. G. E. found that the excellent toughness and shock resisting qualities of Uddeholm's UHB-711 beat the fatigue problem in the latch. Then they found that these same properties, in a blanking die of UHB-711, also permitted them to blank out the latch with a 3/64" radius at the point. Their last question was answered when the latch, heat treated *after* drilling, finish machining and bending, held perfectly to specified tolerances. Final testing by Magnaflux provided a rejection rate of practically nothing. Now Harvard is also getting excellent results from a die of UHB-711 that is blanking a hole 57/8" x 117/8" in 3/8" thick 321 Stainless Steel!

Performance like this is typical of all Uddeholm tool steels. Users are continually finding Uddeholm tool steel the answer to their problems. A complete selection of air, oil and water-hardening types is available. If you have a tool steel problem, or if you merely want the best in tool steel quality, see your Uddeholm sales representative today.

Write For Tool Steel Stock List No. 12

UHB

UDDEHOLM COMPANY OF AMERICA, INC.

Tool and Die Steels
Specialty Strip Steels

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Cleveland: 4540 East 71st Street, DIamond 1-1110
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O K carbide tool bores 2 diam, turns shoulder and bottom, in less than 2 min.

combination boring heads
multi-diam tools
trepanning tools
form cutters
gang mills
reamers

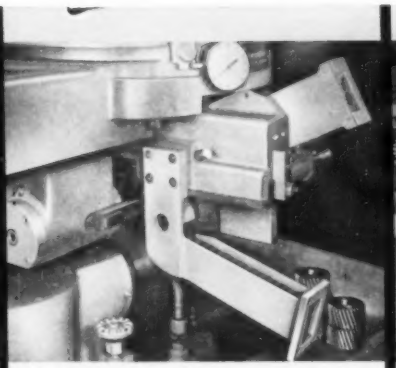
At the Waterbury plant of Vickers Incorporated, machine time is drastically reduced with this special O K carbide head for boring and counterboring cast iron hydraulic pump bodies. A single plunging cut completes four operations at the same time.
You can buy similar O K multiple-operation tools, boring heads, reamers, trepanning tools, gang mills for $150.00 to $200.00. An investment that pays for itself many times over, generally the first week the tool is on the job. Engineering service is free. Write for Book of 50 Engineering Prints of Multi-diam Tools.

modern milling cutters
for modern milling machines

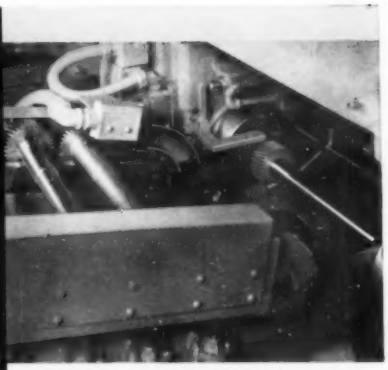
THE OK TOOL COMPANY, INC. • 300 Elm Street • Milford, New Hampshire

FOR FURTHER INFORMATION, USE READER SERVICE CARD; INDICATE A-9-275

INTERNAL 870-C, only vertical internal shaver where a heavy mass (chuck and gear) drives the cutter. Reversals impose no abnormal loads on cutter teeth. This prevents excessive cutter breakage. Extras—plunge shaving.



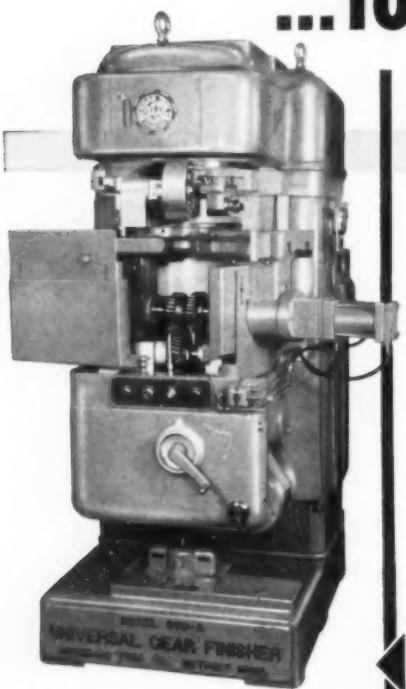
UNDERPASS 870 Gear Finisher for fastest shaving—long or short run—of spur, helical, herringbone or shoulder gears. Extras—the new knee, new cutter-saving drive, crowning cutters, easy to set up and operate.



READILY AUTOMATED—Michigan 870 and 870-A shavers can be partly or fully automated. They are the only vertical shaving machines featuring 'straight-through' automation. They can be automated to load or unload from front or back.

TO GET BETTER GEARS AT LOWER COST

...look for the extras



UNIVERSAL 870-A (with new knee) permits adjustable automatic upfeed to be used with any of the three basic shaving methods. Extras—faster approach, longer tool life. Optional crown shaving attachment (permits shaving of a series of gears with varied crowns using only one tool).

Michigan's latest 870-series Gear Finishers are loaded with EXTRAS. A new knee assembly brings all controls to the front—and puts the operator closer to the work. Operators like ease of setup, vernier and dial locating, and the simple locking. Work located above cutter makes manual loading safer, automatic loading easier. Machine ways are up out of the way of contamination by chips or foreign matter. Timken bearings, extra-rugged fully splined shafts and a shock-absorbent drive, provide a sturdy no-backlash drive. Starts and stops are cushioned to keep cutters operating longer. Every installation has the EXTRA of being individually Michigan Application Engineered to cut costs.

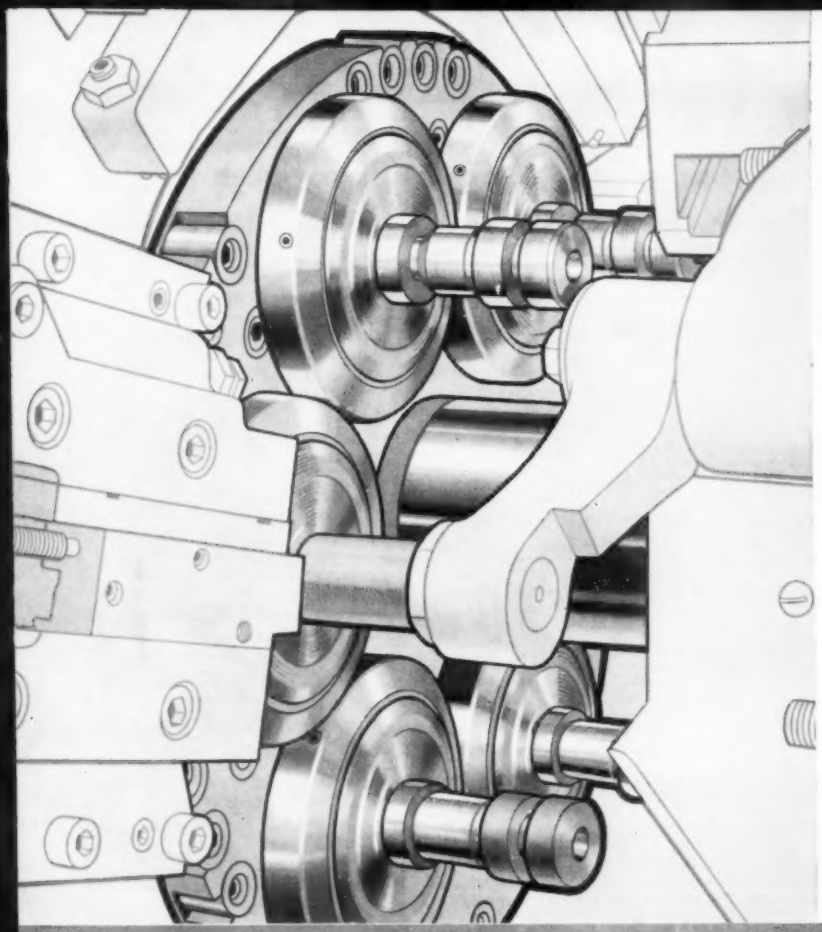
Write for descriptive literature.

May we have the Michigan Tool engineering representative in your area show you how Michigan gear finishing can make your geared parts even better.

MICHIGAN TOOL Company

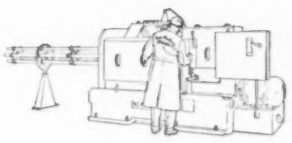
from blank to finished gear

7171 E. McNICHOLS RD., DETROIT 12, MICH., U.S.A.
IN CANADA: COLONIAL TOOL CO. LTD.

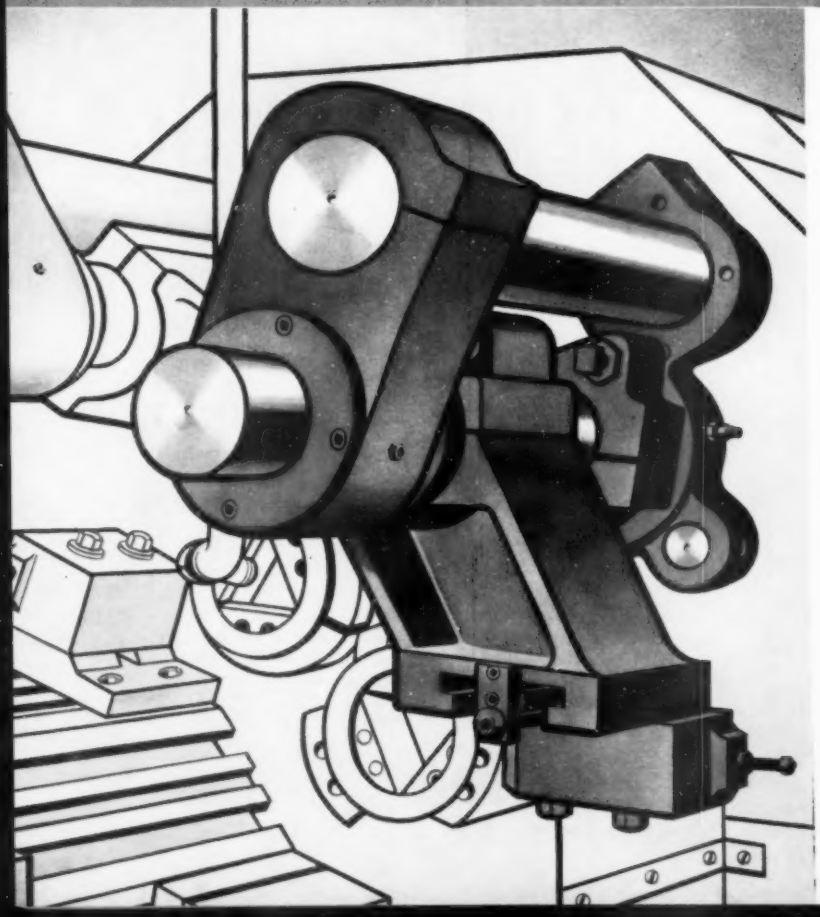


Look at New Britain's

new automatic bar machines

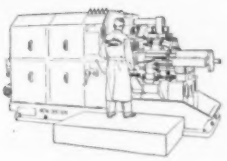


The widest range of spindle speeds among machines of comparable capacity and accuracy.



Look at New Britain's

exclusive chucker arms



All the ruggedness of a cross slide, but with two-way motion for cutting O.D.'s, I.D.'s, tapers and radii and for recess boring, in addition to facing cuts. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

NOW DO ALL THESE OPERATIONS UP TO 400% FASTER (and more)

SHAVING TOOLS

DRILL HEADS

DRILL GRINDERS

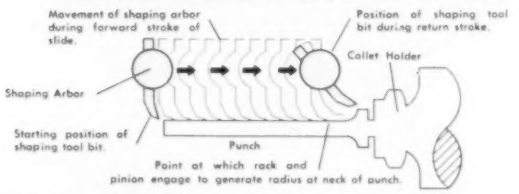
DISC FILERS

TOOL ROOM SHAPERS

- Machined complete in one set-up to within a guaranteed accuracy of ±.00025"...
- Contours, surfaces and punches with curved necks
- Brass electrodes
- Die sections
- Machine components
- Core pins

with the JEMCO Form and Punch Shaper

OPERATION OF SHAPING ARBOR *Arbor does not rotate!*


Movement of shaping arbor during forward stroke of slide.
Position of shaping tool bit during return stroke.
Collet Holder
Shaping Arbor
Starting position of shaping tool bit.
Punch
Point at which rack and pinion engage to generate radius at neck of punch.

CASE HISTORIES

Total length of punch:	1.4"	2.75"	3.15"	3.15"	2.35"	2.55"
Length of profile:	0.6"	0.8"	3.15"	3.15"	1.2"	1.8
Rooted/straight through:	rooted	rooted	straight through	straight through	rooted	rooted
Shaping time in minutes:	270	225	180	90	90	250

Distributors in principal cities. Write for complete information

See us at the western A. S. T. E. Tool show, booth #500

Jersey manufacturing company

401-E LIVINGSTON STREET • ELIZABETH 1, NEW JERSEY

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Consultations and FREE Demonstrations on Request

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can save you money

The term CERROTECHNICS refers to the technology of using bismuth alloys (CERRO*ALLOYS) in some 63 known industrial operations. It can save you substantial time and money in: anchoring stationary machine parts . . . holding permanent magnets . . . securing punches and dies . . . reclaiming cracked dies . . . bending thin-walled tubing . . . making molds for plastics . . . electroforming molds . . . reproducing master patterns . . . filling blow holes in castings . . . making chuck jaws . . . and handling many other industrial tasks.

CDP

For the complete listing of 63 CERRO ALLOY applications, send for our new information-packed "HOW TO" (No. J4) booklet.

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*T.M. Cerro de Pasco Corporation

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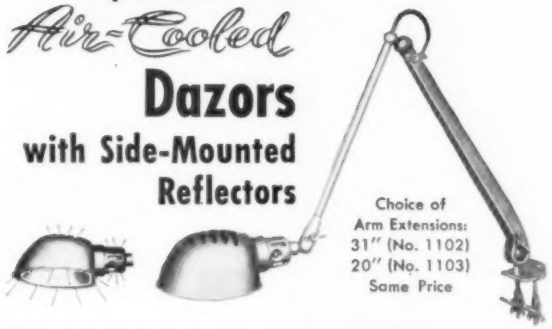
For Hard-to-Light Machines . . . New Adjustable-Arm

Air-Cooled

Dazors

with Side-Mounted Reflectors



Choice of Arm Extensions:
31" (No. 1102)
20" (No. 1103)
Same Price

Now it's as easy to beam light into a recess, or around an offset, as onto a simple tool or bench position. This Adjustable-Arm Dazor with side-mounted reflector offers same low-cost air-cooled efficiency and positive tension control as top-mounted style. Uses 60-w bulb. Call your Dazor distributor. Dazor Manufacturing Corp. St. Louis 10, Missouri.

. . . Makers of

DAZOR FLOATING LAMPS

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Royco Precision Ground Taps are engineered for your particular job.

Royco Taps are ground entirely between centers using precise machines and tooling. High quality is not sacrificed for mass production methods.

Royco stocks a large supply of special taps ready for immediate delivery plus a complete line of standard taps and thread gages. All types are ground — including acme, square thread, buttress etc.

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Royco *Service Will Save You Money*

Royco Tap & Tool Corp.
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BOX 268B NORTH ERANCH, MICH.

ASTE DATA SHEETS

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Only the JERSEY TURRET DRILL HEAD

SHAVING TOOLS

ARBO-2 Automatic indexing turret type Multi-Spindle Drill head.

TAPPING CAPACITY
1/8 to 9/16"

DRILLING CAPACITY
0 to 19/32"

PUNCH SHAPERS

DRILL GRINDERS

DISC FILERS

TOOL ROOM SHAPERS

DRILLS – *from 2 to 7 holes*

TAPS – *from 2 to 7 different sizes in "IN ONE SET-UP"*

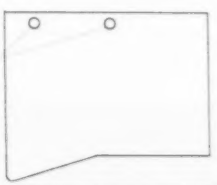
10 SPINDLE SPEEDS

- *Fits any single spindle verticle drill press or miller*
- *No reversing of drill spindle necessary for tapping*

.177" drilled blind to ¼" depth

.257" drilled blind to 1¼" depth

.093" drilled through



CASE HISTORY

AIR HARDENED tool steel piece normally required the use of 6 drill presses—*NOW WITH ONLY ONE DRILL PRESS THE PRODUCTION WAS DOUBLED!*

.177" drilled through and reamed to .187" with a ⫠ **.0005"** parallelism

Distributors in principal cities. Write for complete information

Jersey manufacturing company

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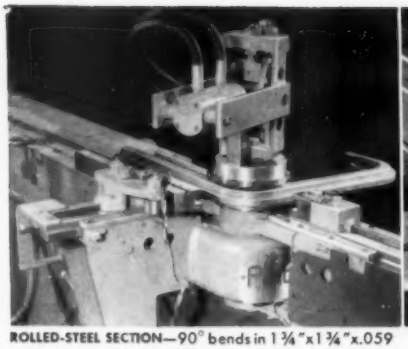
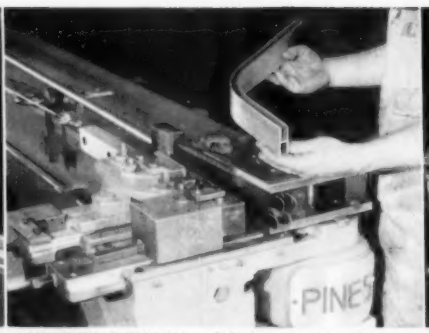


ROLLED-STEEL SECTION—90° bends in 1¾"x1¾"x.059 stock produce automobile seat frames. Split dies with automatic actuator make possible speeds up to 500 bends per hour.

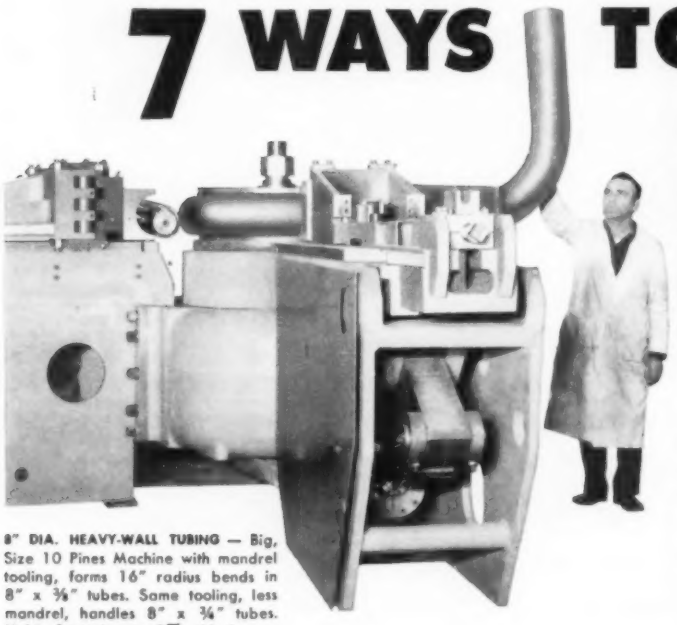


ALUMINUM EXTRUSION — Window awning ribs are accurately formed on a 5¾" inside radius using leaf-spring mandrels. Split-die tooling speeds loading and unloading operations.

ALUMINUM TUBING — Bending four 1" O.D. x .035 workpieces simultaneously on a 3½" CLR produces up to 1200 pieces per hour for large furniture plant.

7 WAYS TO CUT COST

Production Bending . . . the "PINES-WAY"



8" DIA. HEAVY-WALL TUBING — Big, Size 10 Pines Machine with mandrel tooling, forms 16" radius bends in 8" x ⅜" tubes. Same tooling, less mandrel, handles 8" x ¾" tubes. Holds flattening to 8%, thinning on outside to 10%.

Hundreds of metalworking plants have found it possible to effect substantial savings by applying Pines Machines in fabricating a wide range of tubing, pipe, extruded or rolled-shaped parts. As illustrated, they are profitably used today on large or small work, and on both short as well as long run jobs. Production-wise and cost-wise, you will find bending the "Pines-Way" is a fast, accurate metal forming method. For assistance with any job or a cost analysis, call on Pines Engineers without obligation.

Write **FOR FREE DATA SHEETS**

For additional cost cutting ideas write for free copies of "Pines News" — illustrates latest bending techniques applied to actual jobs.

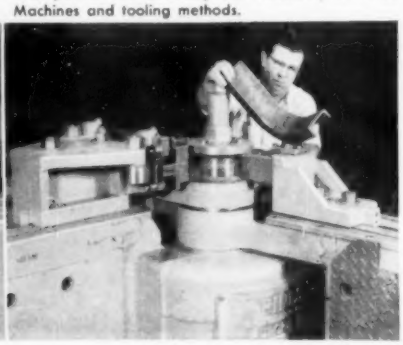
PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery | 693 WALNUT • AURORA, ILLINOIS

AIRFOIL SHAPE—13/16" x 2⅛" aluminum aircraft struts are now rapidly formed at production speeds. Segmented mandrel and wiper die insure smooth, accurate 90° bends on 4¼" CLR.

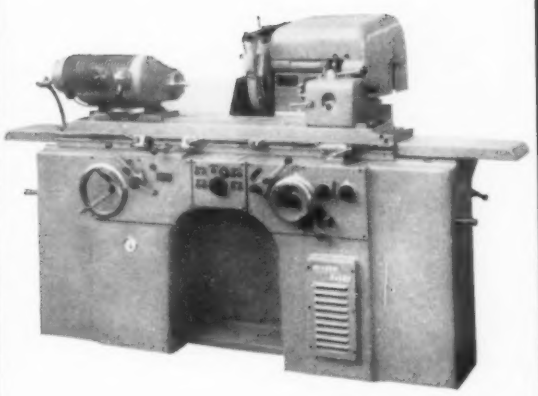
HEAT EXCHANGER COILS — This tooling set-up produces accurate 180° serpentine bends in 2" O.D. x .065 tubing on 2½" CLR. Operating speed is 150 bends per hour.

STEEL CHANNELS — Bending heavy 4" x 5.40# steel channels on a 3½" I.R. for truck frames is another example of the versatility and efficiency of Pines Machines and tooling methods.



olivetti

high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding as standard equipment on all models.



3 types:

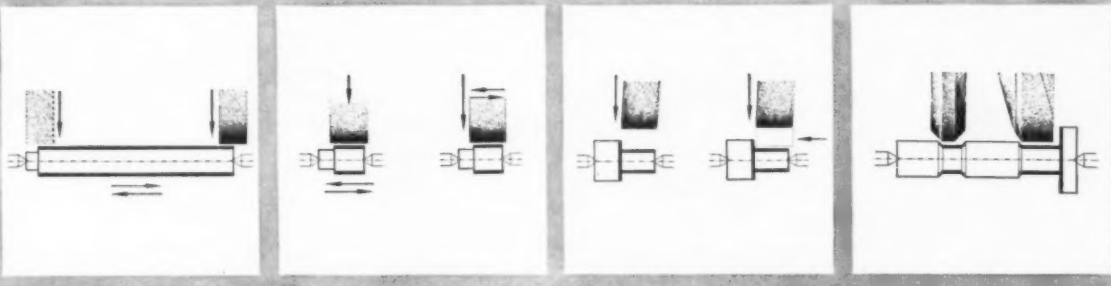
UNIVERSAL. *Swivelling wheelhead, internal grinding attachment, infinitely variable speed headstock.*

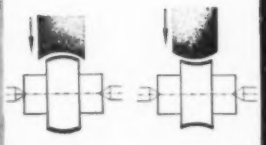
PRODUCTION. *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

PLUNGE. *Similar to production type but with axially oscillating wheelhead and hand table control only.*

4 sizes:

10", 12", 14", and 18" swings (with choice of lengths between centers).





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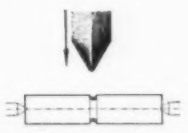
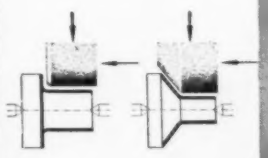
CATALOG ON REQUEST *Handsome, illustrated, 22 pages. Please write for it.*





Now... THE MOST RUGGED And Most Accurate HEIGHT GAGE MADE!

Delicacy or fragileness no longer need be associated with accuracy!

The *new* PROTECTOR Gage Tip* provides complete protection against BLOWS FROM ALL DIRECTIONS — even *head-on* — and the Cleveland INDI-AC Electronic Height Gage still remains accurate to MILLIONTHS of an inch.

An accidental blow, due to handling, or mistake in setup, merely deflects the Gage Tip instead of transmitting the blow and damaging the gaging elements.

Only available on *new* Cleveland INDI-AC Electronic Height Gages — or as a replacement for standard tips on INDI-AC'S now in service.

*Patent Applied For.

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VAILL
TUBE END-FORMING MACHINES
shape and form tube ends
fast... accurate... at less cost

FREE — New Bulletin T-1 shows, describes VAILL tube end forming machine VERSATILITY for . . .

Beading • Flaring • Flanging • Sinking
Expanding • Grooving • Threading • Reducing
Double Lap Flaring • Double Lap Flanging
on Tubing up to 6" Diam.

THE VAILL ENGINEERING CO.
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FORD
SOLID CARBIDE END MILLS FOR

***Ferrous and Non-Ferrous Metals**
***Heat-Treated Steels**
***Non-Metallics**

Nine different styles in a full range of diameters, (and in both straight and right hand spiral flutes) bring the benefits of higher production speeds, lower tool costs to hundreds of milling jobs. The greater rigidity and smoother action of FORD carbide end mills pays off in faster cutting, better finishes, longer tool life. Available from Ford stocking jobbers.

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Precision Manufacturer of
H.S.S. and Carbide Rotary Cutters • Carbide End Mills • Special Tools

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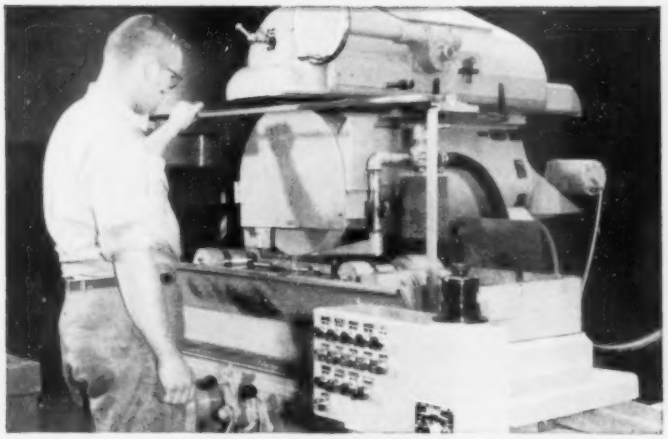
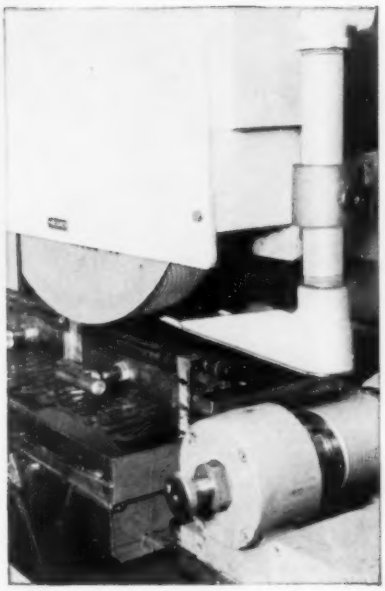
Thompson — TRUFORMING CUTS COSTS 66% ... DOUBLES PRODUCTION AND IMPROVES PRODUCT AT THE OLIVER CORPORATION





In the production of ledger plates, used in the cutter bar of mowing machines, The Oliver Corp. of Chicago, formerly first milled the teeth, then hardened the plate. The hardening process caused distortion and variance in uniformity which impaired the cutting action of the bar.

On the advice of Thompson engineers, a Type BB Truforming Grinder with a 2½" width grinding wheel was installed to process these ledger plates as a finished grinding operation. The plates are now heat treated first and the teeth are then formed by grinding.

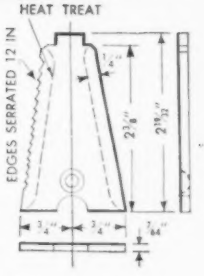
The installation of the Thompson Truforming Grinder has accomplished the following results:

1. **Cut total production costs from $3.18 to $1.06 per 100 pieces.**
2. **Increased the production rate from 1600 to over 3600 pieces per 8-hour shift.**
3. **Provided constant uniformity in the workpieces.**
4. **Eliminated the full-time service of one man.***
5. **A pair of $160.00 milling cutters formerly produced 20,000 pieces. A $60.00 grinding wheel now produces well over 40,000 pieces.**

The leadership of Thompson Truforming Grinders results from 25 years of research and development work in crush form grinding. Today these machines are opening up hundreds of practical, time-saving, profit-improving and cost-cutting applications for industry.

Thompson's engineering experience is available to you without obligation. Write for Catalog T558.

Automatic machine cycle allows operator time to countersink hole in plate—an operation formerly requiring one man's full time.



LEDGER PLATE
High Carbon Manganese Steel
Rockwell C52-58

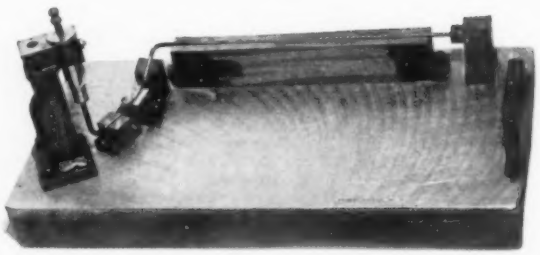
"Keep Thompson in mind for that daily grind"

THE THOMPSON GRINDER CO.
SPRINGFIELD, OHIO

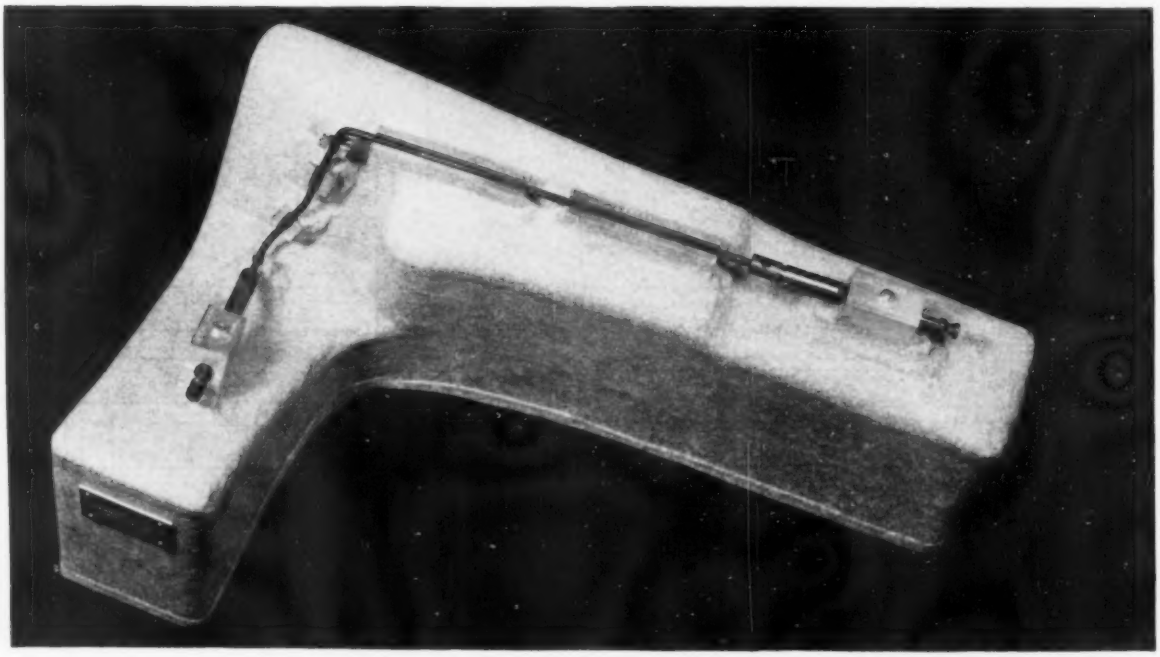
Thompson SURFACE GRINDERS

Plastic tooling with BAKELITE Epoxy Resin

saves time, saves machining, saves weight



Checking fixture below is made with tooling compound produced by **Ren Plastics, Inc.**, Lansing, Mich., using BAKELITE Epoxy Resin. Notice its cleaner design and construction compared to older one of steel, above. Both check the same type part. New fixture is lighter, dimensionally stable, quickly produced.



Curves in the tubing of jet engines by Pratt & Whitney Aircraft, East Hartford, Conn., were formerly checked in machined metal fixtures like the one at top.

The new fixture above is a lamination of glass cloth and a tooling compound based on BAKELITE Brand Epoxy Resin. The record shows this method—

SAVES 76 per cent in tool-making time!

SAVES 80 per cent in machining . . . freeing machines for other work!

SAVES 70 per cent in weight . . . making storage and handling simpler!

The plastic tools are dimensionally stable. In fact, their reduced coefficient of expansion disposed of temperature variation problems previously encountered.

Learn how the low cost, efficiency, and convenience of tooling with compounds based on BAKELITE Brand Epoxy Resins can be applied to your operations. Write Dept. IH-01E.

BAKELITE BRAND **PLASTICS**

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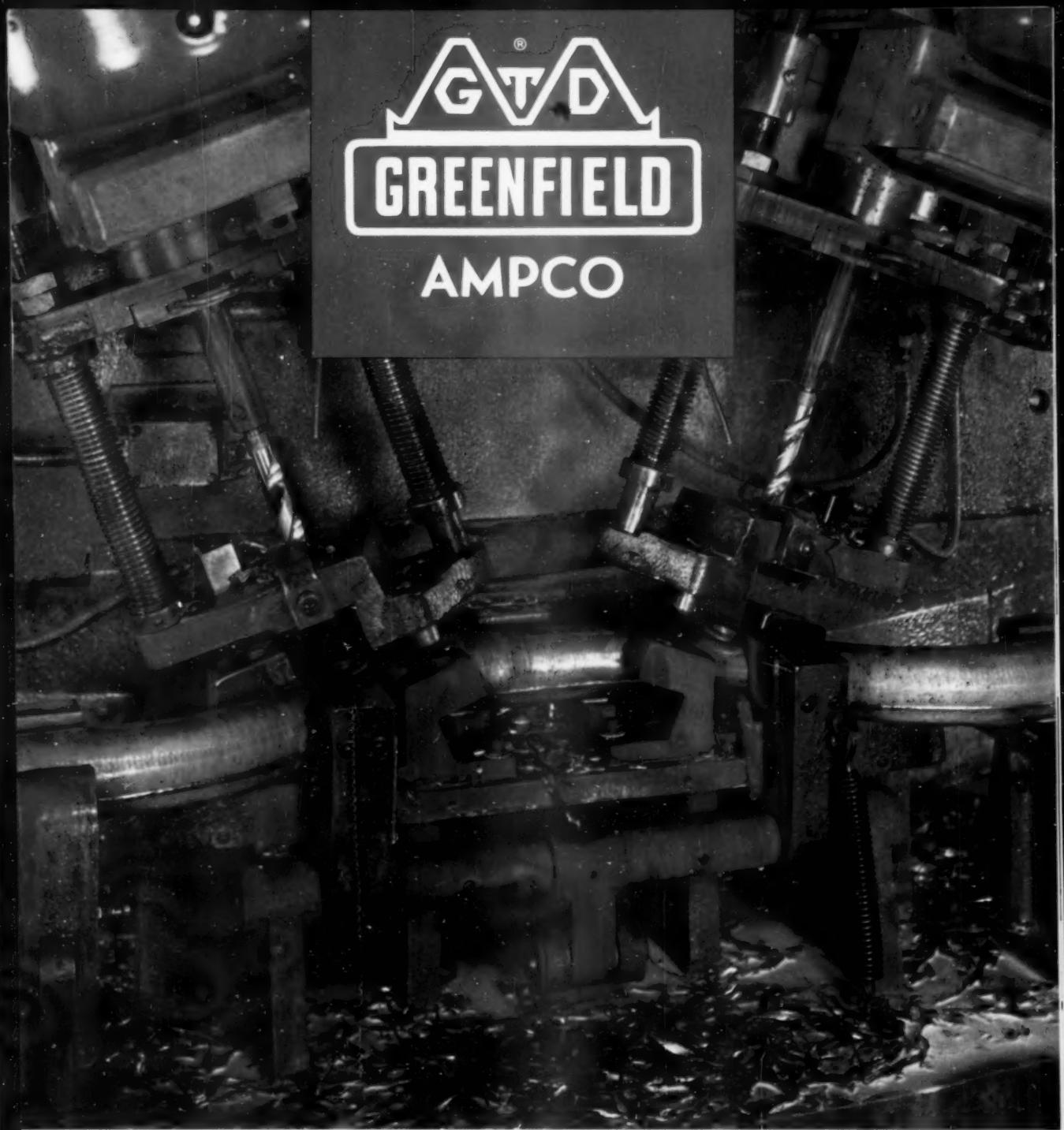

ROUGH...TOUGH...and FAST At Dana Corporation Auto Frame Plant in Detroit, drills are really subjected to harsh treatment to give required production. 55/64″ High Speed drills wham into these body cross tubes at terrific speeds and feeds. They punch through, first a disc welded onto the tube, then the tube walls, a total of 5/8″, whirling out 5″ blue chips up to .060″ thick.

No coddling of drills here. They have to stand the gaff. And that's just what these GREENFIELD-AMPCO drills are built to do. Try them today! Call your nearest distributor.

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"Hello central – please connect me with the Acme Machine Shop"..... and if everything was going o.k. you'd get your party.

But modern industry could scarcely exist without today's instant, direct automatic telephones. Yet some shops still try for modern production with yesterday's threading tools.

Better use that modern phone to call in a GEOMETRIC man and learn how New Geometrics may update your threading operations and increase your profit margin.

Geometric has no yearly model, improvements are incorporated as developed – so the newest Geometric is always the best.

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Tool Steel Topics

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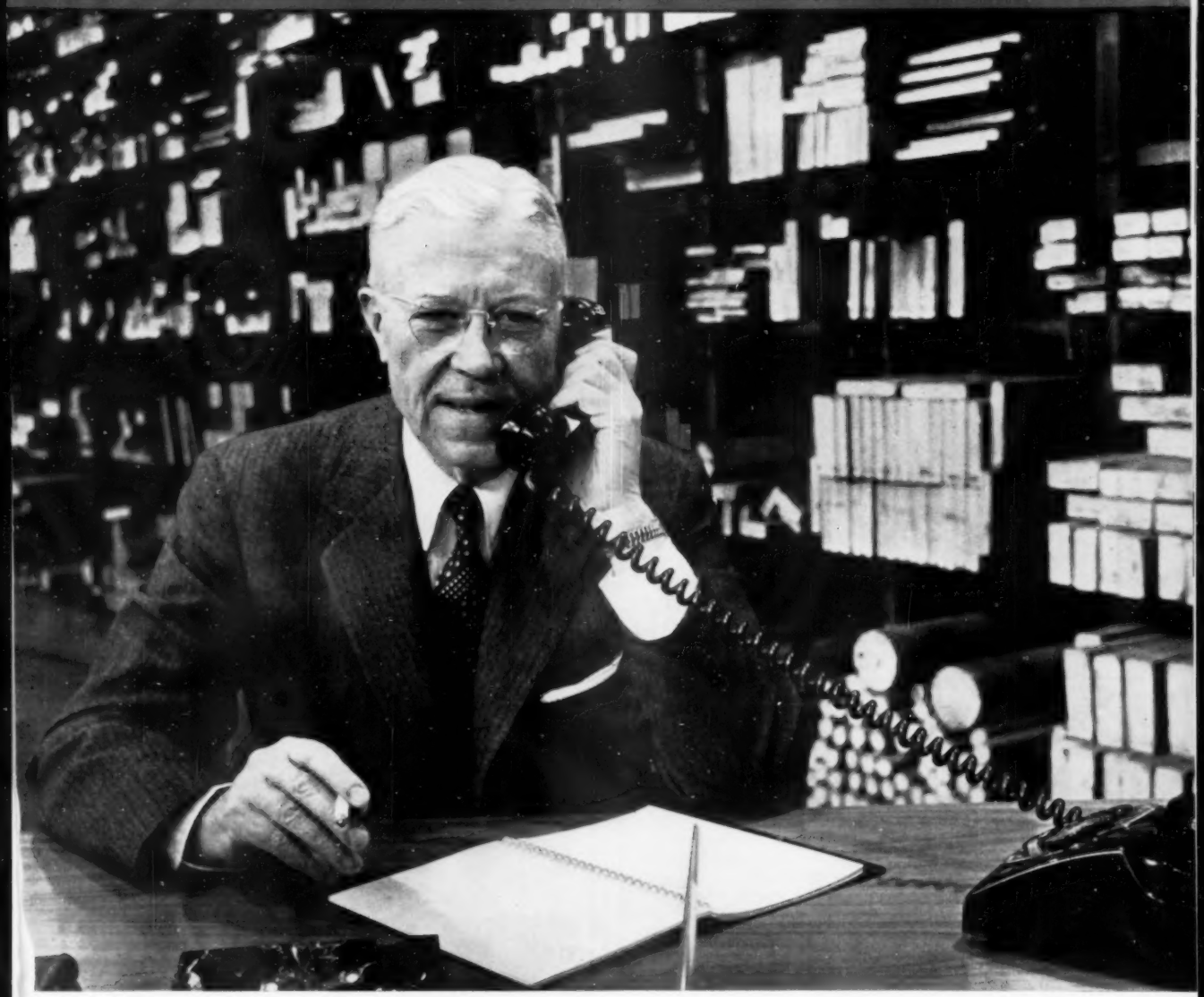

For Answers to Tool Steel Problems

CHECK WITH YOUR BETHLEHEM DISTRIBUTOR

Virtually every business day you are faced with a question or two about tool steel. On occasion the solution is relatively easy, such as ironing out some detail about delivery. But often it can be considerably more complex—perhaps weighing the merits of two similar grades, or determining the proper cycle of heat-treatment to obtain a more effective die life.

Whatever the problem, it calls for expert opinion, and that's where your Bethlehem tool steel distributor comes in. For he's a specialist in tool steel matters, and it's part of his job to see that your questions are answered promptly and courteously. Besides, he can also save you time when you need tool steel, for his diversified stocks are ready to go at a moment's notice. Make it a point to check with your Bethlehem distributor often. It will take but a few minutes at most, and it's one of the wisest moves you can make.

BETHLEHEM STEEL

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CHICAGO 31, ILLINOIS
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Automatic Self-Opening Stud Driver — 100 Series Featuring Collapsible Type Trip Gage!

Automatic take-up for wear on jaws. Affords accurate maintenance of projection heights. Inexpensive method of clutch renewal gives double wear at half the cost.

"Extracto" Stud Remover for Aircraft Engines

Small tool nose diameter for use in close quarters. Permits re-use of studs by gripping thread on nut end of stud — will not mar threads. Made in standard sizes for #10 to ⅝" studs.

"Bull Dog" Stud Driver Designed for Use With Impact Wrenches

Built for rugged use on heavy engines. Equipped with Titan Design, Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip" Combination Stud Driver and Puller

Incorporates roll action to grip as little as ½ in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

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ANNOUNCEMENT

BY POPULAR DEMAND

MICRO MINIATURE END MILLS

are now available in 2 flute 3/64", 5/64", 7/64", 9/64" and 11/64" sizes from local stocks. Those former "SPECIAL" sizes ⊗ are now "STOCK SIZES" offering the advantages of stock prices and deliveries.

When you think of small END MILLS—think of MICRO MINIATURES

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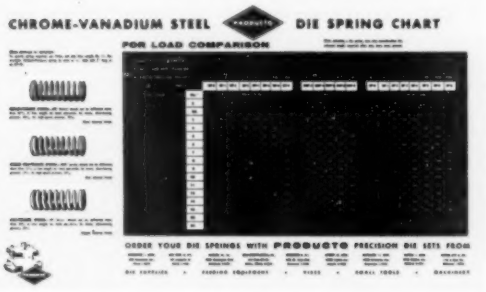
DIE SET DATA

available from **PRODUCTO**

Die Set Catalog No. 11

This easy-to-use general catalog contains compact, complete listings and illustrations of Producto's broad line of die sets and die makers' accessories. There's a separate price book with *net* prices. A unique new binding enables you to have the technical data and price information side-by-side—no flipping back and forth required. *Color* spotlights key information and speeds up your use of the catalog. Many important new accessory items are included. Free.*

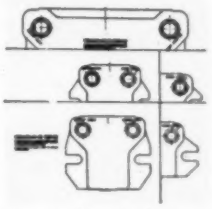

CHROME-VANADIUM STEEL
DIE SPRING CHART
FOR LOAD COMPARISON
ORDER YOUR DIE SPRINGS WITH PRODUCTO PRECISION DIE SETS FROM

Die Spring Comparison Chart

Die spring selection is simplified by this 12″ x 20″ chart in two colors, suitable for wall mounting. Convenient for use at the drawing board, bench or in the stockroom. Covers all three series of Producto chrome-vanadium die springs: Medium-pressure 50% deflection, Medium high-pressure 37% deflection, and High-pressure 30% deflection. Free.*

Die Set Digest

Every issue of this 8-page quarterly publication is packed with valuable hints for designers, manufacturers and users of dies. Hard-to-find information is presented clearly in the *Digest:* "Die Set Maintenance in the Pressroom"; "How to Select and Use Die Springs"; "How to Lubricate for Longer Life". Write and ask to receive *Die Set Digest* regularly. No charge.*

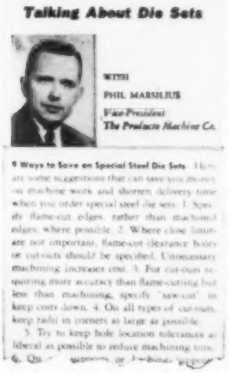


Die Set Templates

Accurate full-size templates for Producto rear-pin die sets. Save time and simplify layout for the busy die designer. $3.50 set. Write today.

Die Set Specification Stamp

Rubber stamp for tracings, prints. Provides spaces for die set ordering information. Free.*



Ad Reprints

Valuable die set know-how is provided in recent "Talking About Die Sets" columns: *How to Save on Steel Specials, Steel vs. Semi-steel,* and others. Send for complete file, free.*

*WRITE TODAY for these useful and informative diemaking aids. Requests on company letterheads will be filled promptly.

THE PRODUCTO MACHINE COMPANY
930 Housatonic Avenue, Bridgeport 1, Connecticut

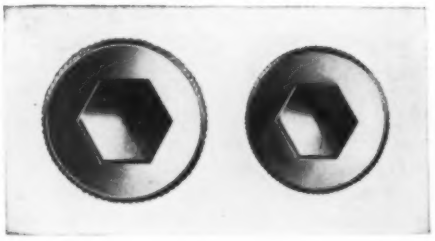
Wherever die sets are used

PRODUCTO

PRODUCE MORE WITH PRODUCTO PRECISION DIE SETS

NEW UNBRAKO socket cap screws with *pHd**

have design features that provide higher reliability in all sizes by increasing usable fastener strength as much as 134%



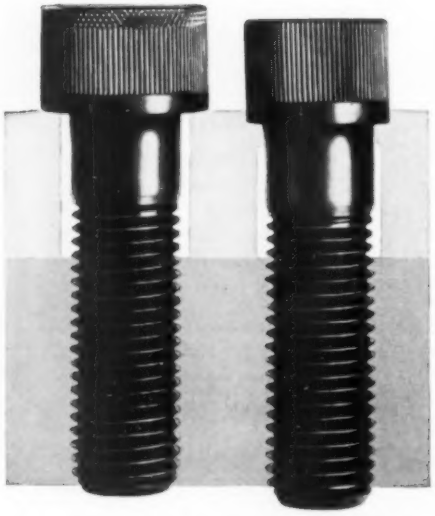


ILLUSTRATION COMPARES NEW UNBRAKO pHd cap screw (left) with same size screw of ordinary design. The larger head of the UNBRAKO pHd can carry much greater loads without indenting into the bolted material. This means greater clamping force and longer fastener life under dynamic loads. The larger socket in the UNBRAKO pHd makes possible greater repetitive tightening.

pHd stands for "proper head design"—a factor in higher product reliability

ADVANTAGES OF THE NEW UNBRAKO pHd SOCKET CAP SCREWS

- Heads are designed to carry greater loads. Diameters have been increased without changing heights.
- Miniaturization. Space and weight-saving design through use of smaller diameter or fewer screws. The 170,000-190,000 psi of these fasteners can be used to greater advantage.
- Reduction of fatigue failures. pHd allows consistently higher preloading, a major factor in lengthening the fatigue life of threaded fasteners.
- Fewer loosened threaded fasteners under shock or vibration.
- Elimination of washers under the heads of cap screws in many applications where they are used to increase the effective bearing area.
- Minimization of effects of oversized holes on the head-bearing area and resulting increase in holding power.

The bearing area surface of the new UNBRAKO pHd, enlarged to hold the bearing stress to 80% of the axial tensile load on the screw, increases the holding power of the screw by as much as 2⅓ times. The head diameter increase, a maximum of 17% in the larger sizes, increases usable fastener strength as much as 134%. This means greater clamping force and longer fastener life under dynamic loads in tension applications. The head diameters, enlarged on 5/16, 7/16, 5/8, ¾, ⅞ and 1 in. body diameters, also prevent the screw head from indenting the material being assembled—a fault that normally reduces, and sometimes even dissipates, the vital preload or tensile stretch that keeps the screw tight and prevents fatigue failures. The larger head diameter also provides room for a bigger wrenching socket where required and this, in turn, makes tightening to designed preload easier and more certain.

The new UNBRAKO pHd socket cap screws are now available through authorized industrial distributors at no increase in prices. Specify them when ordering. Also available with Nylok† self-locking feature. For technical data and specifications, send for Bulletin 2406. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 37, Pa.

COMPARISON OF UNBRAKO pHd AND CONVENTIONAL DESIGN

Each size can now be utilized with equal reliability. The bearing stress is consistent from size to size in the new UNBRAKO pHd socket cap screws.

SCREW SIZE	HEAD DIAMETER (in.)		BEARING AREA (sq. in.)		LOAD TO INDENT IN CAST IRON (lb.)		% INCREASE USABLE STRENGTH	TIGHTENING TORQUE (lb.-in.)‡	
	Old	pHd	Old	pHd	Old	pHd		Old	pHd
¼	.375	.375	.041	.041	3,280	3,280	—	165	180
5/16	.438	.468	.047	.072	3,760	5,760	54	325	360
⅜	.562	.562	.102	.102	8,150	8,150	—	600	660
7/16	.625	.656	.116	.148	9,270	11,800	27	1,000	1,040
½	.750	.750	.188	.188	15,000	15,000	—	1,450	1,590
⅝	.875	.937	.203	.305	16,200	24,400	51	2,900	3,190
¾	1.000	1.125	.223	.432	17,800	34,600	94	5,050	5,600
⅞	1.125	1.312	.254	.594	20,300	47,500	134	8,000	8,900
1	1.312	1.500	.364	.785	29,100	62,800	116	10,550	13,600

‡Normal recommended seating torques for unplated screws, fine threads

hiRf High Reliability factor

Research at SPS is realistic, for it faces the fact that industry is always seeking structural and mechanical components with increasingly higher standards of predictable performance. By installing SPS high reliability fasteners in your assemblies, you increase overall product reliability.

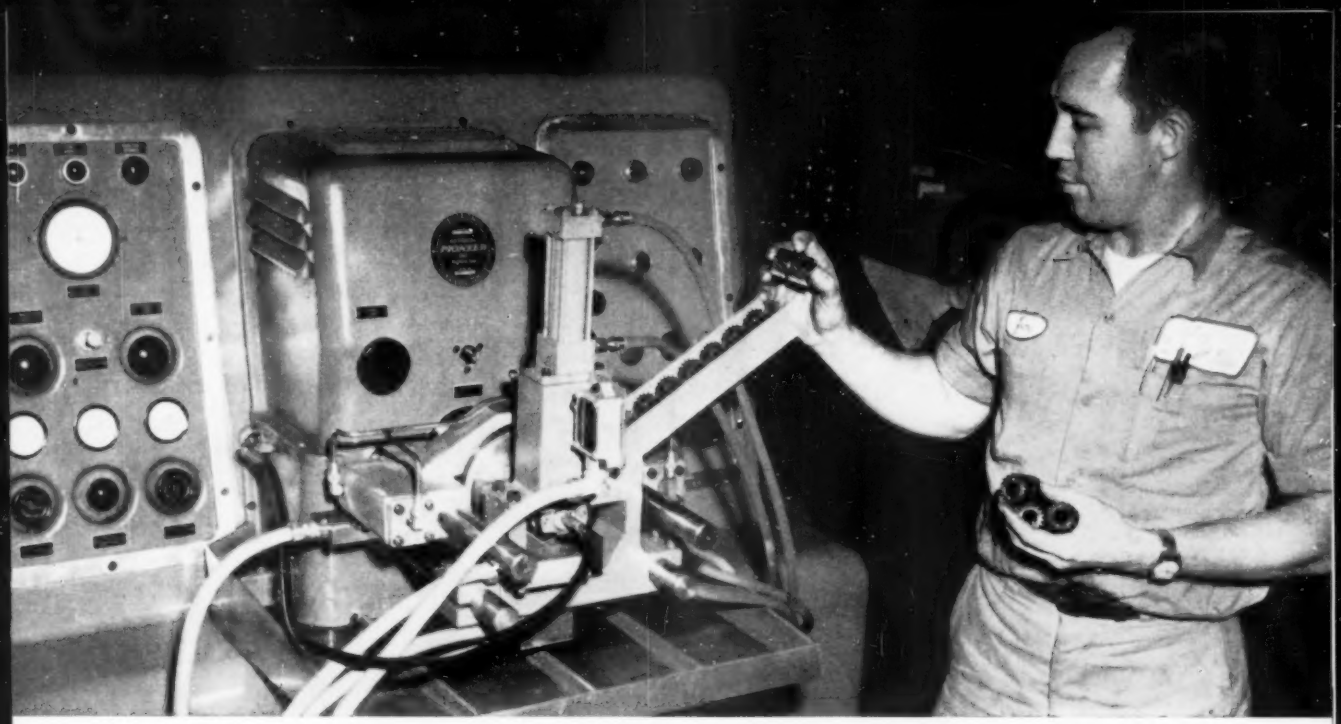
"High Reliability" is a booklet just published by SPS. Write for your copy today.

†T.M. Reg. U.S. Pat. Off., The Nylok Corporation

We also manufacture precision titanium fasteners / *write for free booklet*

SPS **Jenkintown • Pennsylvania**

Standard Pressed Steel Co. • The Cleveland Cap Screw Co. • Columbia Steel Equipment Co. • National Machine Products Co. • Nutt-Shel Co. • SPS Western • Standco Canada Ltd. • Unbrako Socket Screw Co., Ltd.



THIS GEAR TELLS THE STORY . . . hardened steel, 60-62 Rockwell C, with a .685" $^{+.000"}_{-.001"}$ rough bore 2" long to be honed to a finished size of .6978" $^{+.0005"}_{-.0000"}$ with .0002" allowable taper.

all new and **30%** faster...

auto-size* honing

Compact, the new AUTO-SIZE Honing Machine requires only 18 square feet of floor space and is easily tooled for automation (photo above) or manual operation (inset right).

THESE FIGURES PROVE IT . . . *240 pieces per hour* (actual cycle time per piece, 12 seconds) held to within .0001" of nominal size and finished to 8 micro-inches with only .00005" taper!

Continuous air gaging of the work piece *by the honing spindle itself during the honing cycle* is the secret—permitting both rough honing and final finishing to be accomplished in one *uninterrupted* operation using the same stones. As the automatic cycle starts (the operator merely loads and unloads), hogging begins at the predetermined spindle speed and stone pressure. Electronic controls, actuated by the spindle air gage, automatically increase spindle speed as nominal size approaches and then, as finished size is reached, stop the spindle and eject the piece.

Honing of any bore up to 2½" in diameter is faster, more economical, more consistent and independent of operator skill. Write today for literature and specifications.

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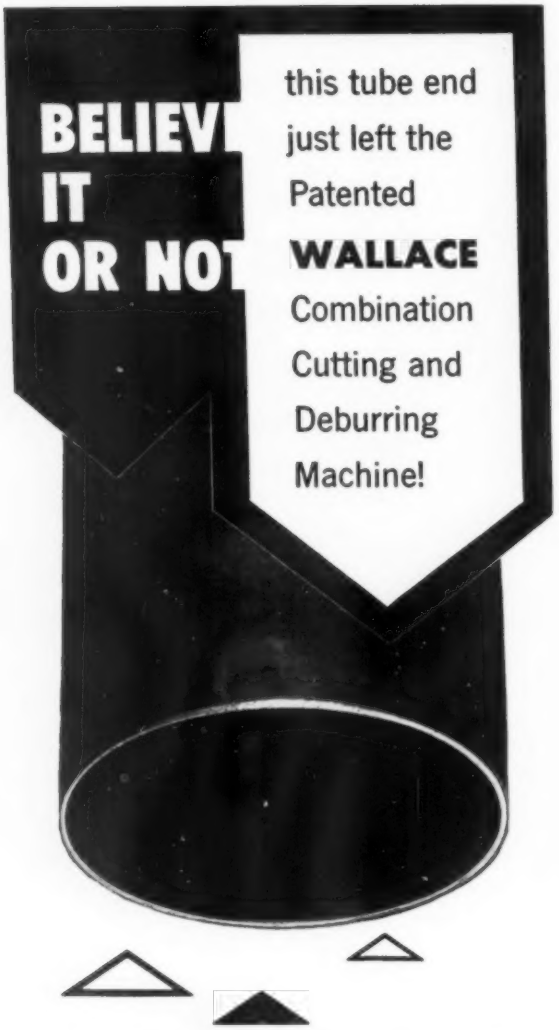

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A NEW LOW PRICED HIGH CLASS PERFORMER

Made by the originator of ground-from-the-solid Rotary Files, and pioneer in this type of Carbide Mill, who presently offer the largest range of standard types, shapes, and sizes.

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OPERATE EFFICIENTLY AT USUAL CARBIDE SPEEDS, YET PERFORM BEAUTIFULLY AT THE SLOWER SPEEDS OF STEEL CUTTERS

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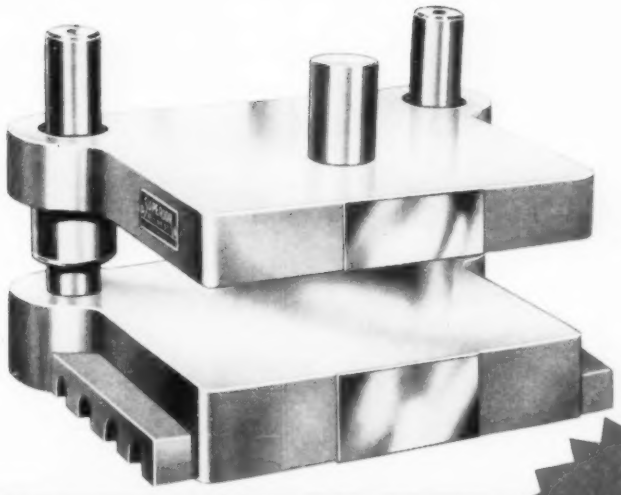


SUPERIOR DIE SET Exclusives

SAVE TIME AND CUT OVERALL DIE MAKING COSTS!!

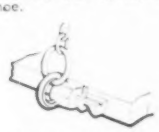
No fumbling or wasted time with large or small die sets when you use Superior. Assembly and disassembly of these precision sets is rapid. In addition they provide safety insurance . . . protection for the skilled hands of die makers and handlers . . . protection also against the ruining of costly dies in handling, or even damaging valuable press equipment.

All Superior Die sets are jig bored to your specifications—result number of die set sizes practically limitless.

Add to this such outstanding features as *Precision Center Marks, Long and Short Bushings, Superfinish Pins* and you can see why Superior is your best die set buy.

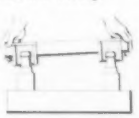
Write today for 24 page catalog.

SAFETY FLANGE
protects fingers by providing roomy gripping space on either side of the die shoe.



LOCK JAW LIFTING DEVICE
removes the danger of handling large die sets.

E-Z LIFT SLING CHAIN
attach to the lock-jaw for immediate lifting.



"REMOVABLE CAP" PINS
End troublesome binding in parting dies.

For Fast Local Service Call These Expert Superior Representatives.

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St. Louis, Mo. Jefferson 5-1223	Memphis, Tenn. Fairfax 3-7727	West Newton, Mass. Bigelow 4-2070
Indianapolis, Ind. Clifford 5-5668	Denver, Colo. Enterprise 234	Agawan, Mass. Republic 9-1132
Rockford, Illinois 3-3931	Winter Park, Fla. 4-0464	Brooklyn, N. Y. Esplanade 6-1368
Dayton, Ohio Hemlock 6209	Racine, Wis. Melrose 2-1900	Cheshire, Conn. Browning 2-4887
Minneapolis, Minn. Franklin 1-1321	Cedar Rapids, Ia. Empire 2-7831	Warwick, R. I. Turner 4-2907

SUPERIOR STEEL PRODUCTS CORP. 2754 South 19th St. Milwaukee, Wis.

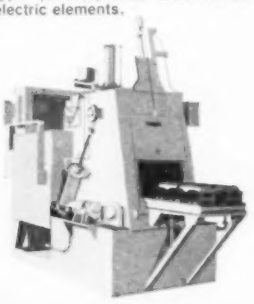
Wherever industry needs heat...

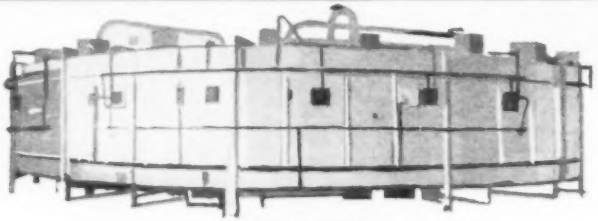
You'll find *LINDBERG* equipment just right for the specific job

Pilot Plant Equipment: Atmosphere tube unit (shown) for processing work at temperatures to 2200° F.

Roller Hearth Furnaces: Continuous electric type (shown) with temperature range 1300° to 2100° F.

Automatic Carbonitriding Furnaces: Automated integral quench type (shown) with CORRTHERM electric elements.

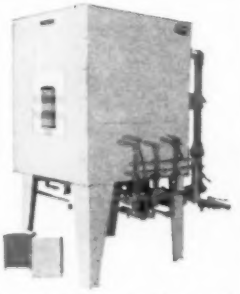




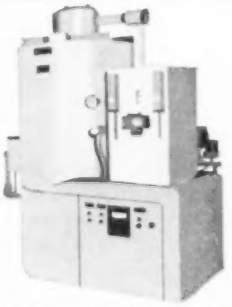
Rotary Hearth Furnaces: Doughnut type field-installed gas-fired furnace (shown) with capacity of 13,000 lbs. per hour.

Vertical Type Furnaces: Carburizing and hardening furnace (shown) with CORRTHERM electrical heating elements.

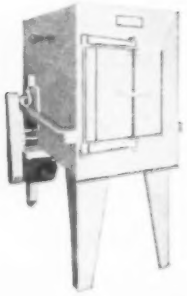
HF Induction Heating Units: Available in 5, 10, 25 and 50 KW units.



Ceramic Kilns: Gas-fired periodic kiln (shown) with temperature range to 3250° F.

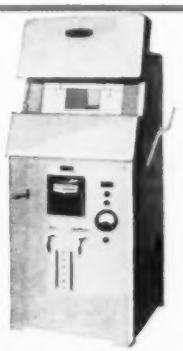


Atmosphere Generators: Hyen generator (shown) for endothermic atmospheres. Generators for all required atmospheres.

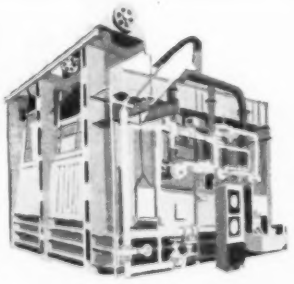


Tempering Furnaces: Box type Cyclone (shown). Temperature range to 1250° F.

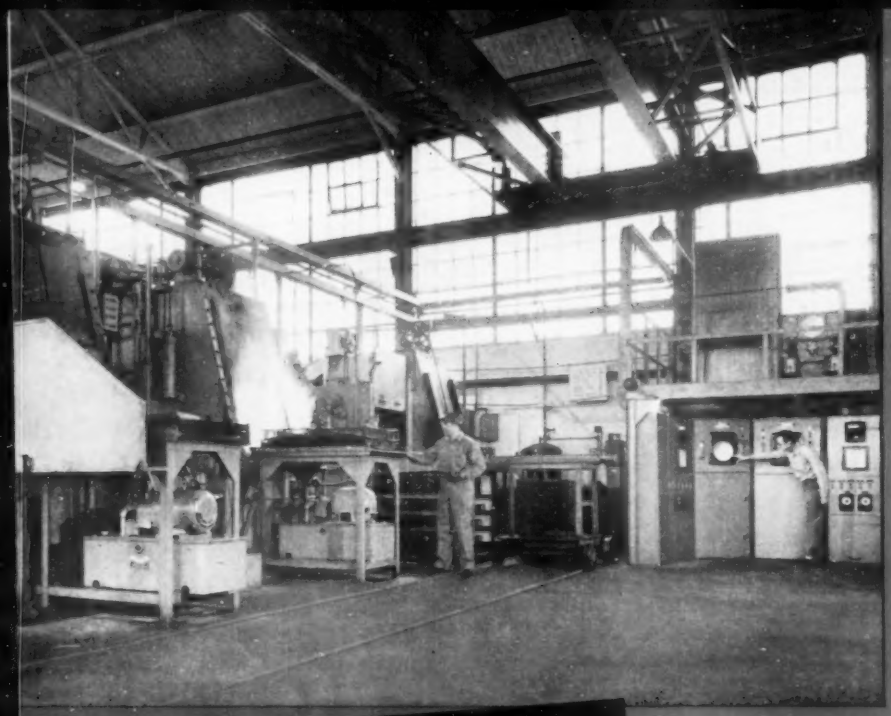
Melting and Holding Furnaces: Electric resistance furnace (shown) with capacities of 750 lbs. to 1500 lbs.



Laboratory Equipment: One-unit box furnace (shown), muffle or for non-oxidizing atmosphere with temperature range to 3000° F.

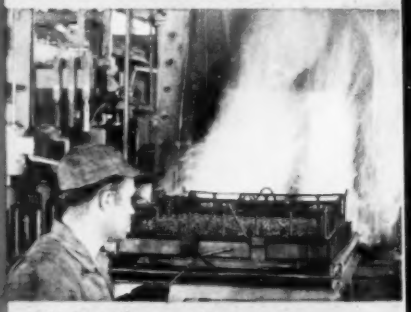


Aluminum Reverberatory Furnaces: Twin-chamber melting and holding furnace (shown) with 45,000 lbs. capacity.



Lindberg-Designed

Charles Hewitt, President of Dayton, says, "The Lindberg installation has kept our production at a consistently high quality level."



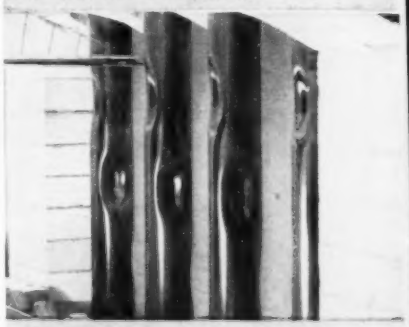
Work loads are positioned manually, but entire furnace operation is fully automatic.

Unique Installation Cuts Heat Treating Costs and Improves Quality at Dayton

Here is a remarkable set-up for general heat treating now in operation at Dayton Forging & Heat Treating Company, Dayton, Ohio. Two integral quench atmosphere furnaces, largest of this type ever built by Lindberg, and one atmosphere tempering furnace in a "three-in-a-row" arrangement that simplifies transfer operation. Combined with Lindberg Carbotrol and Hyen generator, the entire furnace operation is completely automatic, including atmosphere control and recording. Planned by Dayton and Lindberg engineers, the installation runs around the clock, six days a week, reducing costs and producing cleaner end products, brighter job finish, freedom from "decarb" and a consistently higher quality of work.

This is another example of how Lindberg equipment and Lindberg planning can help you find the most effective answer to any problem of applying heat to industry. We cover the field, heat treating, melting and holding, tempering, brazing, enameling furnaces, ceramic kilns, high frequency units, and are in the ideal position to recommend just the type of equipment most suitable for your needs. This can be factory built or field-installed in your own plant, fuel-fired or electric, whatever is best suited to your production processes. Consult your local Lindberg Field Representative (see the classified phone book) or get in touch with us direct. Lindberg Engineering Company, 2447 West Hubbard Street, Chicago 12, Illinois. Los Angeles Plant: 11937 S. Regentview Avenue, at Downey, California.

Lindberg Carbotrol unit automatically controls and records "dew point" and heating cycles of endothermic atmosphere.



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Got a tough work-holding job that's bothering you . . . one which needs quick-acting and powerful clamping?

It's 100 to 1 you'll find the answer among 120 standard DE-STA-CO Toggle Clamps and scores of spindle accessories.

Even more! Our engineers will give you suggestions if you send a print or rough sketch.

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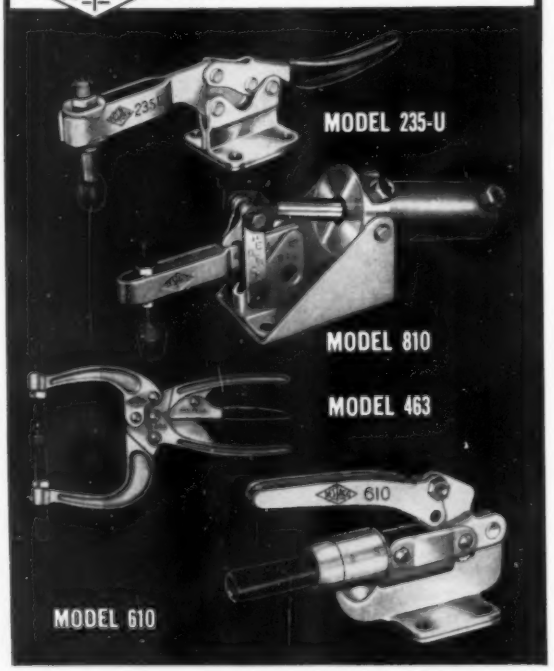

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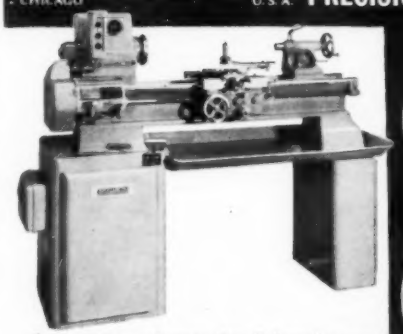

from

to

in 9 seconds or to any intermediate speed INSTANTLY

Just raise or lower the T-handle control, and watch the large tachometer dial in the headstock! Power driven speed changer accelerates or slows the lathe to any desired speed in seconds. 10:1 ratio, gives from 200 to 2000 rpm in direct drive or 40 to 300 rpm in back gear.

Oversized pulleys and shafts are fully supported (eight bearings). Double V-belts throughout eliminate slippage and deliver full power to the spindle. This lathe takes heavy cuts at all speeds and precision finish cuts at high speeds.

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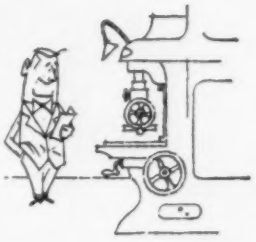
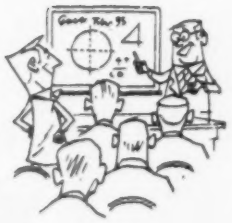


ATTEND fact-packed technical conferences, symposia and panels.



Fifteen major symposia and panels . . . conducted by eminent authorities . . . will be devoted to subjects of vital interest, including: Tooling Space Airframes; Sandwich Construction for Aircraft; Forming the Exotic Metals; Tooling for Electronics; Numerical Control in Missile Production; Plastics in Tooling.

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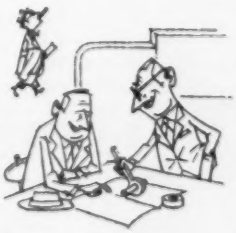
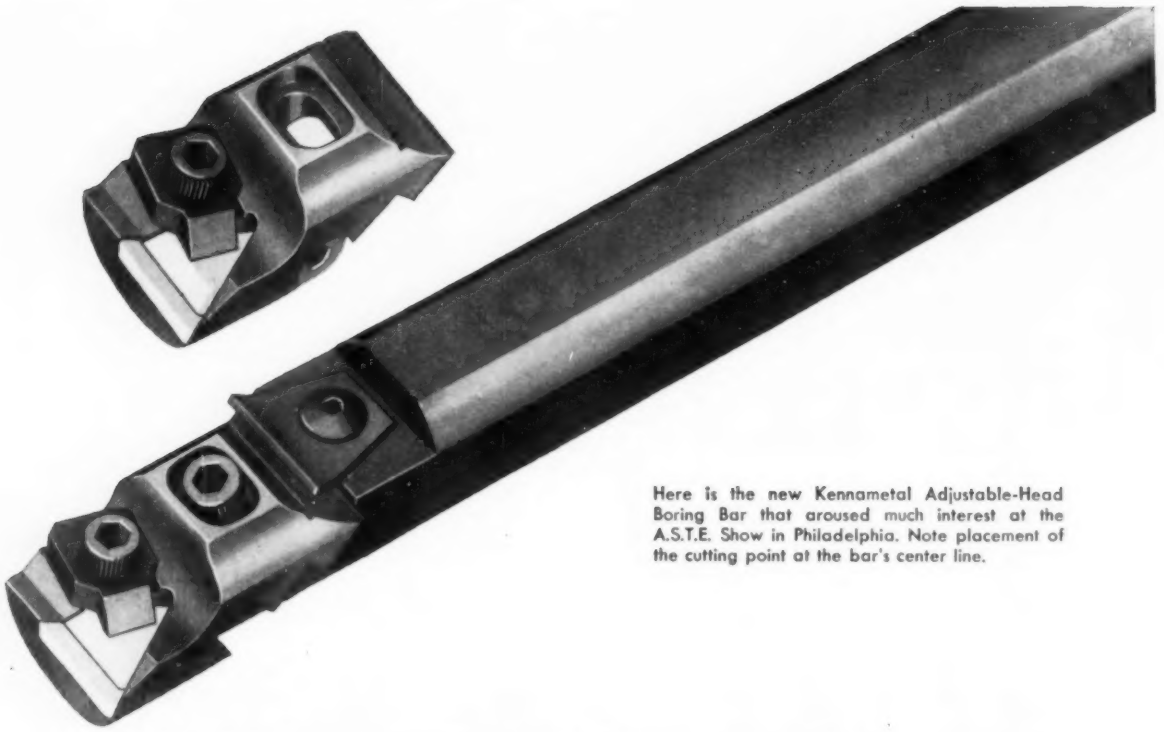
INSPECT some of the finest plants in the Los Angeles Area.



You'll see industry in action, too. Plant tours scheduled include: Byron Jackson Tool Co.; Douglas Aircraft Co.; Long Beach Naval Shipyard; Crown Zellerbach Corp.; Consolidated Electrodynamics; Hughes Products Div., Hughes Aircraft; United States Electrical Motors; American Can Co.; Mercury Div., Ford Motor Co.; Lever Bros. Co.; Northrop Aircraft Co.



Here is the new Kennametal Adjustable-Head Boring Bar that aroused much interest at the A.S.T.E. Show in Philadelphia. Note placement of the cutting point at the bar's center line.

Now! Kennametal* Boring Bars with adjustable and interchangeable heads

No need for adjustable head on machine... adjustment is made on the tool itself

Featuring the Kendex* "throw-away" insert principle, Kennametal Adjustable Boring Bars are now available with two and three heads that can be used interchangeably on two different styles of bars. Both bars are made in seven diameters, ranging from 1 to 2½ inches. One style is made with a solid steel shank, while the other utilizes the exclusive K-Bar construction to provide greater rigidity for high precision boring jobs.

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Get more information on the new line of Kennametal Adjustable Head Boring Bars. Call your Kennametal Representative, or write KENNAMETAL INC., Latrobe, Pa.

K-Bar cross section, showing steel core encased by Kennametal sleeve.

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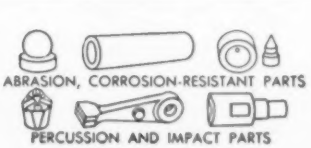

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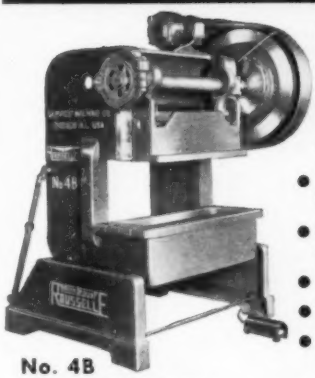

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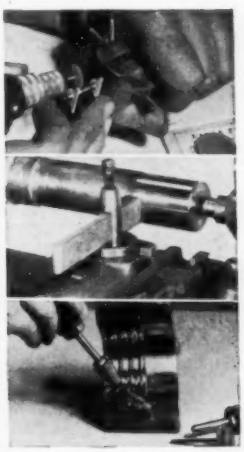

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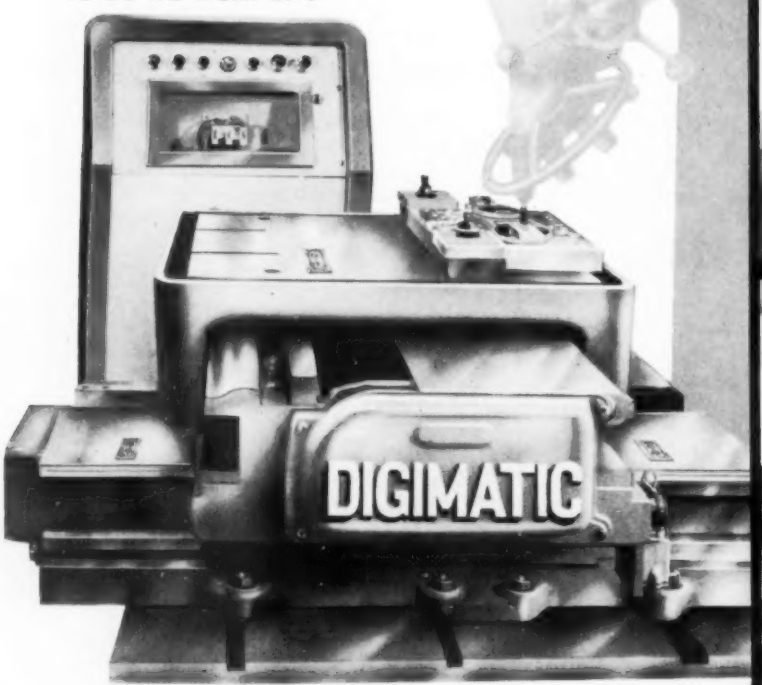

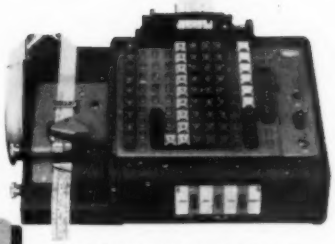

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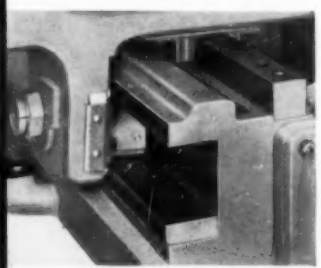

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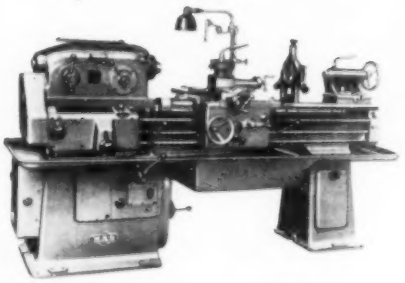
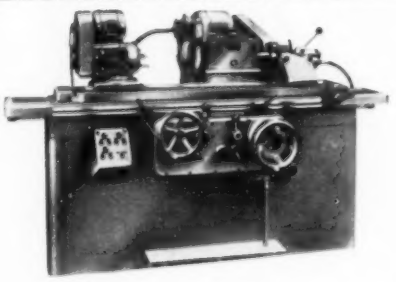


THESE ECONOMICALLY PRICED MODELS ON EXHIBIT UNDER POWER



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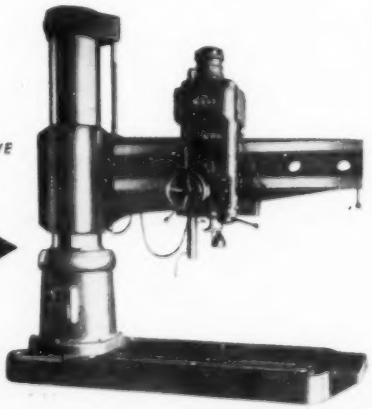

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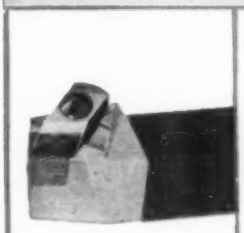
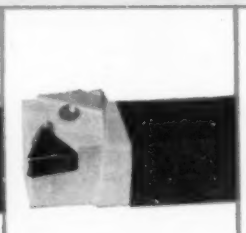
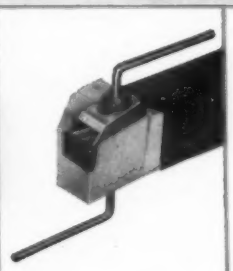


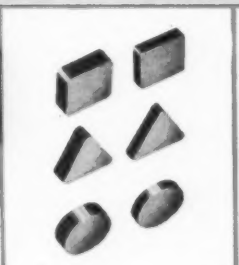
1 **Fully adjustable chipbreaker** . . . in increments of .030". Insures excellent chip control. One piece positive locking. No wasted machine time changing non-adjustable chipbreakers to get proper chip control.



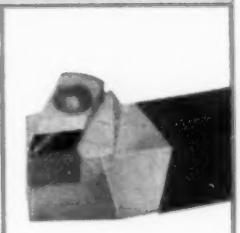
2 **Extra thick carbide anvils** . . . thickest shank-supported anvils in the industry. The thick anvil in Dex-A-Tool gives more rigidity to throwaways and provides the ideal platform for maximum insert performance.



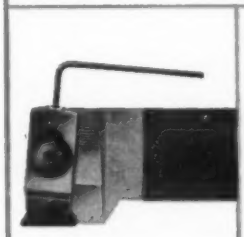
3 **Easy indexing** . . . clamp locking screw may be loosened from bottom as well as top. Simplifies insert indexing when holder is upside down.



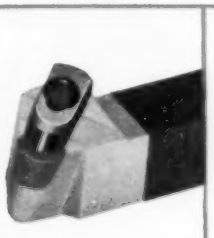
4 **Holds both "thick" and "thin" inserts** . . . allows you to utilize economical thin inserts (⅛") wherever possible and still maintain the advantage of switching to thick inserts (3/16") whenever necessary.



5 **Chipbreaker Clamp Faced with Thick Carbide** . . . provides much more wear resistance than thin carbide coating or cast alloy clamp.



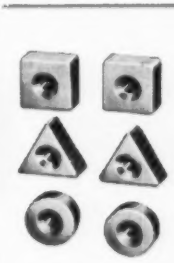
6 **Setscrew chipbreaker clamp** . . . permits fast positive resetting of chipbreaker after insert indexing. Nylon plug engages the setscrew and prevents any loosening of setscrew.



7 **Combination chipbreaker—clamp** . . . single unit construction means no loose chipbreakers to fall out. Inventories reduced. Simpler use gives a savings in production time.

8 **Anvil invertible as well as indexable** . . . extra thickness of anvil allows countersinking of both sides. This permits anvil to be inverted for extra life.

9 **Special high temperature brazing alloy** . . . used in brazing carbide chipbreaker to clamp. Prevents braze failure during high machining temperatures.



10 **Carbide or steel anvils** . . . your choice of carbide or copper plated hardened high speed steel anvils.

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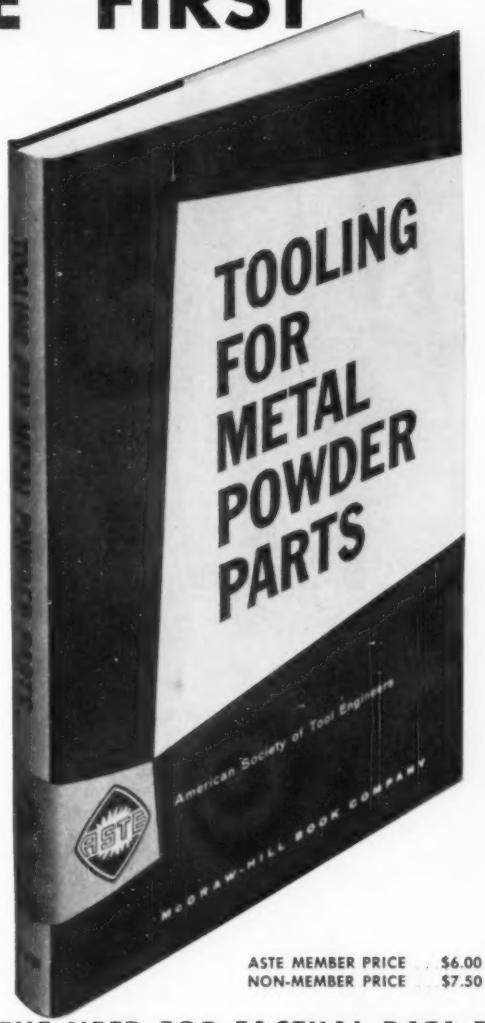

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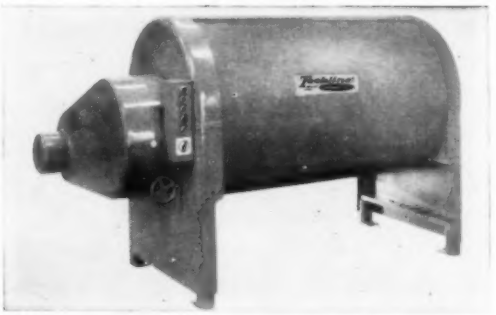

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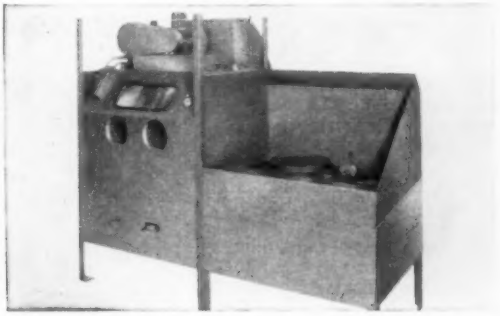

TECHLINE WET BLASTING MACHINES add the new "modular" concept of design to the famous Wheelabrator Liquamatte features, achieving new standards of economy and performance for wet blast precision cleaning and finishing. Standard units are available in a wide range of sizes and capacities.

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Through its new Techline Division, Wheelabrator Corporation offers a wide line of barrel finishing equipment, media and compounds, as well as the long-established Wheelabrator Liquamatte line of wet blast equipment and Liquabrasives.

Because Techline equipment and services are not limited to just one process, its application engineers can be purely objective in recommending the one best combination of process and equipment for your precision finishing needs.

Techline design engineers are specialists in precision finishing, with long experience in designing equipment and planning efficient processing operations. Their designs include many exclusive features that are far ahead of any similar machines now available. And Techline offers a complete range of media, compounds and abrasives, all carefully selected and accurately formulated to consistently produce the finish you specify.

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This service is available to you without charge or obligation. Write for full information on Techline application engineering services.

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Why not measure cutting speeds in dollars saved?

Higher machining speeds, preset and quick-change tooling offer you real cost-cutting opportunities

If all your cutting tools were suddenly less expensive, you could afford to increase machine speeds, couldn't you?

When you stop to examine the facts, by far the highest elements of tool cost are downtime for changing tools, in-the-machine adjustments, and sharpening costs. Often, they are more than 10 times the actual cost of cutting tools consumed. Now, Scully-Jones offers you a way to reduce these costs substantially so that it will pay you to increase cutting speeds, giving you maximum return on the investment that really counts —*your machine tools.*

Formula for determining least cost

"Optimation" is the popular name for the technique of obtaining *least cost* per piece (not lower tool cost) and it's easy to put to work on your large automatics. In plants where it is being used, cut-and-try scrap has been reduced, machine speeds have been increased, and productive machine time has been extended—all for a minimum investment in tooling. To make it work, you need:

1. Preset, quick-change tools
2. Programmed tool changes

You can get the equipment to meet both requirements, plus the experience needed to apply it from Scully-Jones.

To start, we help you figure optimum feeds and speeds for the

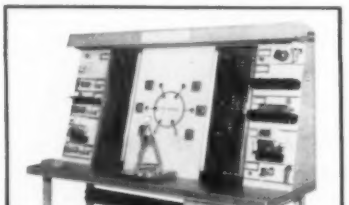


Fig. 1—Scully-Jones "Toolitrol" board is the complete way to put a tool control system to work. Counters keep track of parts produced by each work station. Preset tools are stored in the board, ready to insert in the machine with no cut-and-try adjustments.

tools that limit the machine cycle. They are based on minimum-cost tool life. You don't have to worry if tool changes are needed more often because your machine is being operated at maximum efficiency and besides, tool change time is only a matter of seconds per tool. For example, 9 tools on a 6-spindle

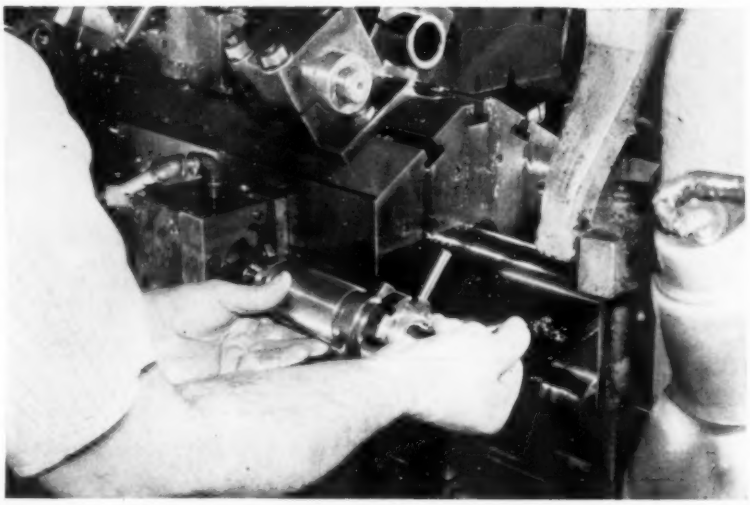


Fig. 2—Standard "Optimation" preset and quick-change holding tools are available for large automatics, designed for front or back removal from tool slides. Tooling makes every operator as proficient as the most experienced setup man.

Conomatic were changed *in 5 minutes and 40 seconds* compared to 42 minutes and 35 seconds with conventional toolholders.

Easy way to set efficiency standards

An important part of the "optimation" story is the fact that tools are preset outside the machine while the machine is producing with another set of tools. Operators who are on incentive like it. Cut-and-try methods are eliminated, and you get the same high efficiency from every operator in your shop.

But even more important, the outstanding accuracy made possible by using presetting tools and fixtures means your cut-and-try scrap loss will be minimized. From the first cut after a tool change, you are producing parts to required specifications.

Control wear below breakdown point

Everyone recognizes that tool wear is accelerated after a certain number of pieces is produced. You can guard against excessive dulling of tools and off-limit parts by using "Toolitrol" boards equipped with Scully-Jones impulse counters. These boards are a storage center for replacement tools, with a worktable for presetting. And the counters give you a true picture of the number of parts produced by each tool. Replacement *in time* not only reduces scrap but guarantees more resharpenings per tool, plus lower sharpening costs.

You can't meet today's competitive costs with yesterday's thinking or tools. Higher cost machines and higher labor rates make it mandatory to minimize nonproductive machine time and keep machines producing at a more efficient rate.

Want more information?

Free literature describes how "optimation" is applied, typical results that have been achieved, and forms for analyzing minimum cost tool life. Write to: Scully-Jones and Company, 1915 South Rockwell Street, Chicago 8, Illinois.

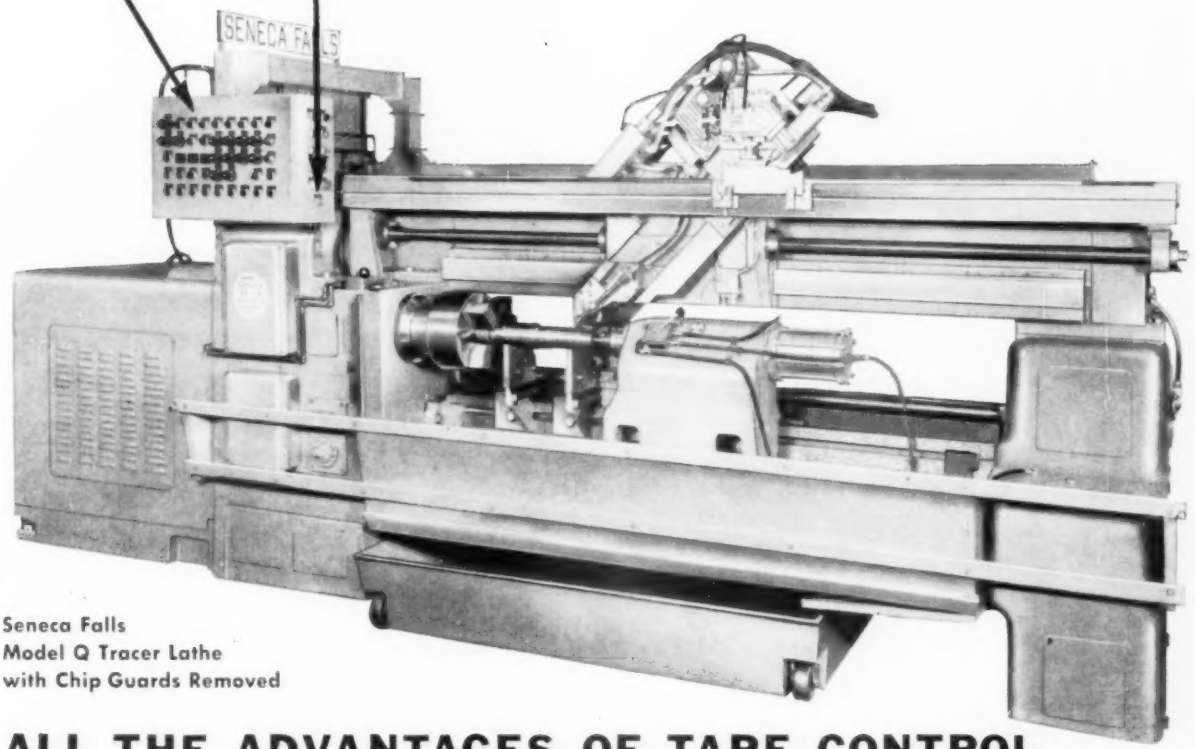
Fig. 3—"Optimation" quick-change chuck with preset adapters. Tools are preset outside the machine by turning the knurled nut on the adapter, using a height-setting tool.

SCULLY JONES **PRECISION HOLDING TOOLS**

DIAL THE SET-UP

PUSH THE BUTTON

YOU'RE IN PRODUCTION!



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  1st —Dial start of cut.
  2nd—Dial end of cut.
  3rd —Dial diameter setting.

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- The system can be applied to any machine or automation sequence.

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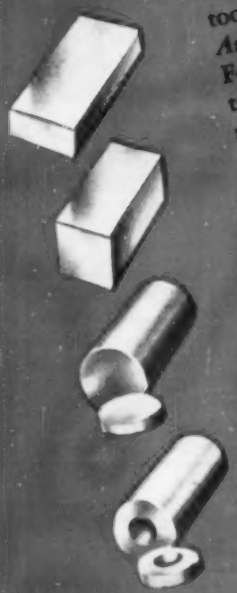

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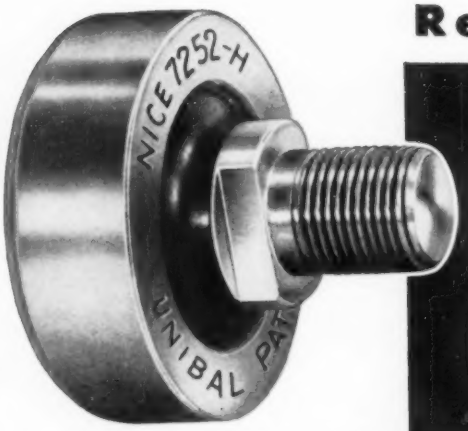
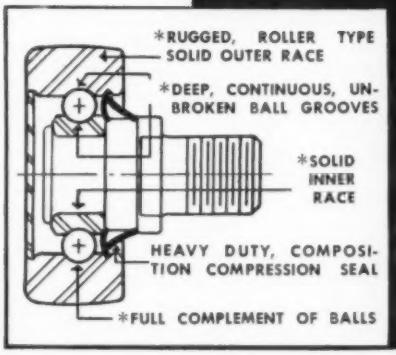


No. 7252-H—Plunger Guide Roller for Hay Baler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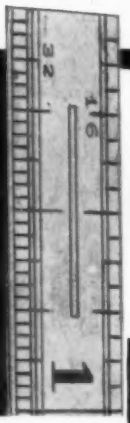

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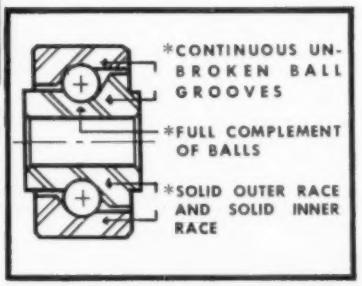

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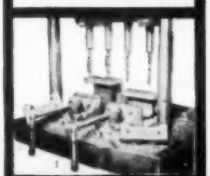

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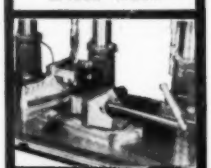

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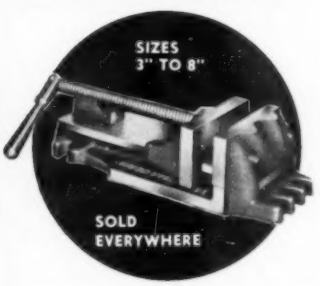

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September 1958

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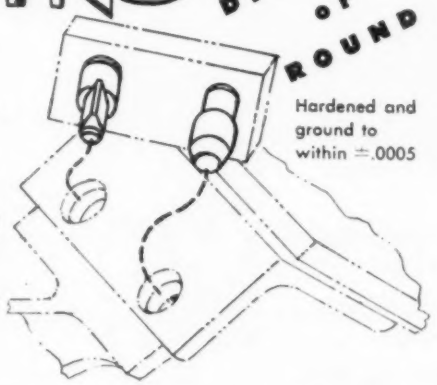

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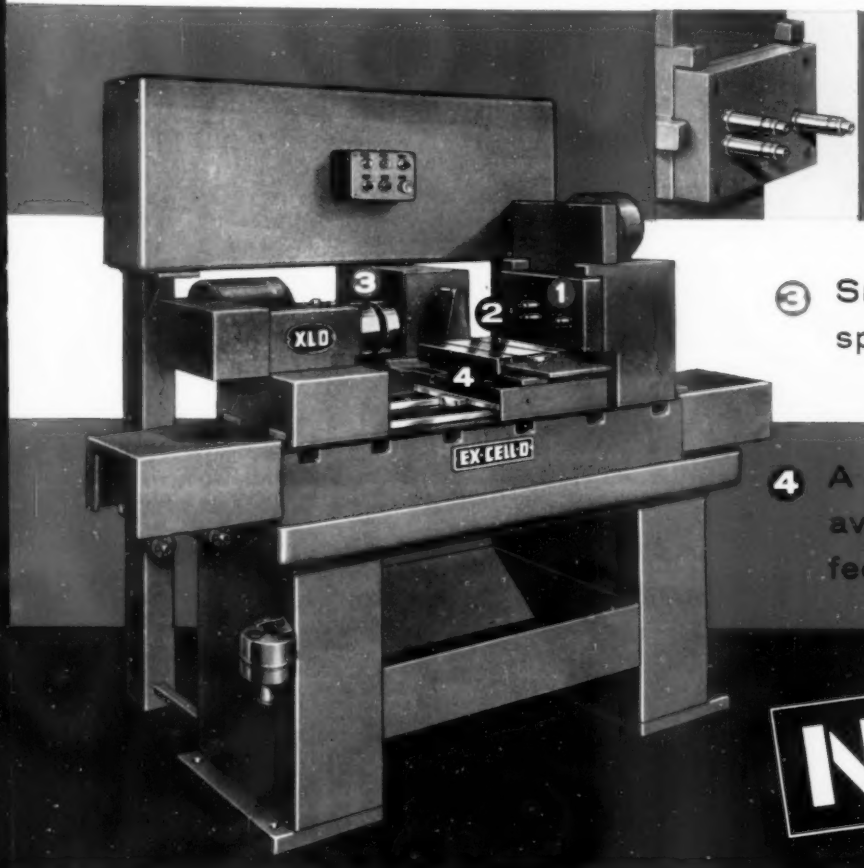

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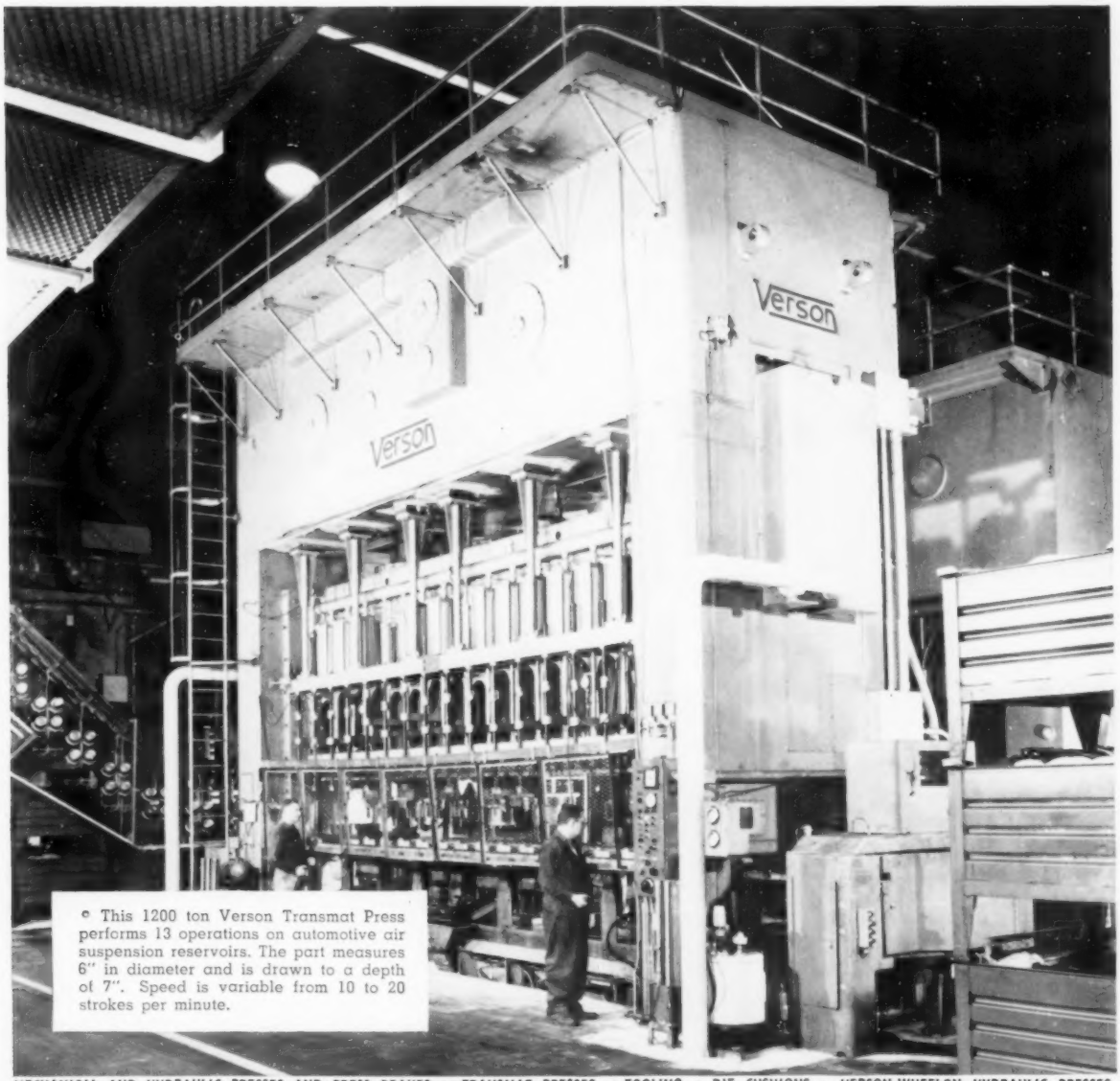

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